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Office of Transportation
and Air Quality

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Summary and Analysis of Comments: Control of Emissions from Nonroad Diesel Engines

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

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List of Acronyms

ABT	Averaging, Banking, and Trading
ACES	Advanced Collaborative Emissions Study
ACS	American Cancer Society
AECD	Auxiliary Emission Control Device
AEO	Annual Energy Outlook
ARV	Accepted Reference Value
ASTM	American Society for Testing and Materials
BOB	Baker and O'Brien
BOL	Bill of Lading
bpcd	Barrels per Calendar Day
CAA	Clean Air Act
CAMx	Comprehensive Air Quality Model with Extension
CASAC	Clean Air Scientific Advisory Committee
CFR	Code of Federal Regulations
CI	Compression Ignition
CO	Carbon Monoxide
COA	Certificates of Analysis
CR4	Four-Firm Concentration Ratios
CRA	Charles Rivers Associates
CRC DPG	Coordinating Research Council Diesel Performance Group
CTA	Credit Trading Area
CVSL	Constant Speed Variable Load Test Cycle
DF	Deterioration Factor
DMDBT	Dimethyl-dibenzothiophene
DOC	Diesel Oxidation Catalyst
DoD	Department of Defense
DOE	Department of Energy
DOJ	Department of Justice
DTAB	Diesel Treated As Blendstock
EGR	Exhaust Gas Recirculation
EIA	Energy Information Administration
EIA	Economic Impact Analysis

EUI	Electronic Unit Injector (ion)
FAA	Federal Aviation Administration
FCC	Fluid Catalytic Cracker
FEL	Family Emission Limit
FOKS	Fuel Oil and Kerosene Survey
FTC	Federal Trade Commission
FTP	Federal Test Procedure
GDP	Gross Domestic Product
GPA	Geographic Phase-In Area
HAD	Health Assessment Document
HAP	Hazardous Air Pollutant
HDS	Hydro-Desulfize
HEI	Health Effects Institute
HEUI	Hydrolic Actuated Electronically Controlled Unit Injector (ion)
HFRR	High Frequency Reciprocating Rig
HHI	Herfindahl-Hirschman Index
I&M	Inspection and Maintenance
IRS	Internal Revenue Service
ISBL	Inside Battery Limits
ISO	International Organization for Standardization
kbpd	Thousand Barrels Per Day
LCGO	Light Coker Gas Oil
LCO	Light Cycle Oil
LDDV	Light-Duty Diesel Vehicle
LM, L&M	Locomotive and Marine Diesel
mmBTU	Million British Thermal Units
MVNRLM	Motor Vehicle Nonroad, Locomotive, and Marine Fuel
MY	Model Year
NAAQS	National Ambient Air Quality Standards
NAS	National Academy of Sciences
NDEIM	Nonroad Diesel Economic Impact Model
NERA	National Economic Research Associates
NMHC	Non-Methane Hydrocarbon

NOx	Oxides of Nitrogen
NPC	National Petroleum Council
NPRM	Notice of Proposed Rulemaking
NR	Nonroad Diesel
NRLM	Nonroad, Locomotive, and Marine Diesel
NRTC	Nonroad Transient Cycle
NSE	National Security Exemption
NTE	Not-To-Exceed
OBD	Onboard Diagnostics
OEM	Original Equipment Manufacturer
OMB	Office of Management and Budget
OSBL	Outside Battery Limits
PADD	Petroleum Administration Districts for Defense
PM	Particulate Matter
ppm	Parts Per Million
PSA	Petroleum Supply Annual
PSR	Power Systems Research
PTD	Product Transfer Document
RfC	Reference Concentration
RFA	Regulatory Flexibility Act
RIA	Regulatory Impact Analysis
RMC	Ramped Modal Cycle
RPE	Retail Price Equivalent
SAB-HES	Science Advisory Board- Health Effects Subcommittee
SBA	Small Business Administration
SBREFA	Small Business Regulatory Enforcement Fairness Act
SCFB	Standard Cubic Feet per Barrel
SDAs	Static Dissipator Additives
SEA	Selective Enforcement Audit
SER	Small Entity Representative
SI	Spark Ignition
SLBOCLE	Scuffing Load Ball on Cylinder Lubricity Evaluator
SO_2	Sulfur Dioxide

TAF	Transient Adjustment Factors
TCO	Temporary Compliance Option
TPEM	Transition Program for Equipment Manufacturers
TRU	Transportation Refrigeration Unit
ULSD	Ultra-Low Sulfur Diesel
VCSB	Voluntary Consensus Standards Board
VOCs	Volatile Organic Compounds
VSL	Value of a Statistic Life
WSD HFRR	Wear Scar Diameter High Frequency Reciprocating Rig
WTP	Willingness to Pay

Commenter Acronyms and EDOCKET Reference Numbers

Name	*Acronym*	*Docket ID #*
Air Transport Association	ATA (Airlines)	OAR-2003-0012-0755
Alaska Dept of Environmental Conservation	AK DEC, Alaska	OAR-2003-0012-0607
Alliance of Automobile Manufacturers	Alliance	OAR-2003-0012-0792
American Farm Bureau Federation	AFBF	OAR-2003-0012-0608
American Lung Association [1]	ALA	
American Lung Association of Metro Chicago [2]	ALA- Chicago	
American Petroleum Institute	API	OAR-2003-0012-0804 – 0808
American Rental Association	ARA	OAR-2003-0012-0612
American Road & Transportation Builders Assn.	ARTBA	OAR-2003-0012-0633
American Society for Testing & Materials	ASTM	OAR-2003-0012-0601
American Society for Testing & Materials (1/19/04 comments)		OAR-2003-0012-0842
American Trucking Associations, Inc.	ATA (Trucking)	OAR-2003-0012-0632
Associated Equipment Distributors	AED	OAR-2003-0012-0831
Associated General Contractors of America	ACG	OAR-2003-0012-0791
Association of American Railroads	AAR	OAR-2003-0012-0700 – 0701
Association of Equipment Manufacturers	AEM	OAR-2003-0012-0669 – 0670
Assn. of Local Air Pollution Control Officials [3]	ALAPCO	
Association of Oil Pipe Lines	AOPL	OAR-2003-0012-0609
BP	BP	OAR-2003-0012-0649
Breakthrough Technologies Institute [1]	BTI	
Building & Construction Trades Dept., AFL-CIO	BCTD, AFL-CIO	OAR-2003-0012-0674 – 0676
CA Air Resources Board	CARB	OAR-2003-0012-0644
California Assemblymember Alan Lowenthal		OAR-2003-0012-0475
Caribbean Petroleum Corporation		OAR-2003-0012-0646
Caterpillar Inc.		OAR-2003-0012-0812
CEMA-CECE	CEMA-CECE	OAR-2003-0012-0598
Chevron Products Company	Chevron	OAR-2003-0012-0782
CHS Inc. (formerly Cenex Harvest States Coop.)	CHS	OAR-2003-0012-0785
CITGO Petroleum Corporation	CITGO	OAR-2003-0012-0707

Clean Air Council	CAC	OAR-2003-0012-0613
Clean Air Task Force	CATF	OAR-2003-0012-0508
CNH Global	CNH	OAR-2003-0012-0819
Colonial Pipeline	Colonial	OAR-2003-0012-0694
Colorado Department of Public Health and Environment	CO DPHE, Colorado	OAR-2003-0012-06887
Connecticut Department of Env Conservation	CT DEP	OAR-2003-0012-0653
ConocoPhillips		OAR-2003-0012-0777
Countrymark Cooperative, LLP	Countrymark	OAR-2003-0012-0602
Crown Central Petroleum Corporation	Crown	OAR-2003-0012-0640
Cummins Inc.		OAR-2003-0012-0650
Deere & Company		OAR-2003-0012-0692
Dept of Defense Steering Services Committee- Navy	DOD- Navy	OAR-2003-0012-0617
Detroit Diesel Corporation	DDC	OAR-2003-0012-0783
Deutz		OAR-2003-0012-0820
Electric Power Research Institute	EPRI	OAR-2003-0012-0772
Electric Power Research Institute- from Ron Wyzga		OAR-2003-0012-0587
Engine Manufacturers Association	EMA	OAR-2003-0012-0656 – 0657
Environment Northeast [2]		
Environmental Advocates of New York		OAR-2003-0012-0523
Environmental Defense		OAR-2003-0012-0821
Ergon, Inc.		OAR-2003-0012-0634
Euromot		OAR-2003-0012-0822 – 0823
ExxonMobil		OAR-2003-0012-0616
FarWest Equipment Dealers Association	FWEDA	OAR-2003-0012-0679
Federal Aviation Administration	FAA	OAR-2003-0012-0682
Flint Hills Resources	FHR	OAR-2003-0012-0667
Frontier Oil Corporation		OAR-2003-0012-0621
Gary-Williams Energy Corporation	GWEC	OAR-2003-0012-0753
General Electric Transportation Systems	GE, GETS	OAR-2003-0012-0784
Griffin Industries		OAR-2003-0012-0119
Group Against Smog and Pollution [2]		
Houston- Office of the Mayor		OAR-2003-0012-0630

Idaho Barley Commission [4]	IBC	
Idaho Grain Producers Association [4]	IGPA	
Idaho Wheat Commission	IWC	OAR-2003-0012-0645
Illinois Farm Bureau	IFB	OAR-2003-0012-0673
IL Lieutenant Governor Pat Quinn		OAR-2003-0012-0781
Independent Fuel Terminal Operators Association	IFTOA	OAR-2003-0012-0671 – 0672
Ingersoll-Rand Company		OAR-2003-0012-0504
International Brotherhood of Teamsters	IBT	OAR-2003-0012-0664
International Union of Operating Engineers	IUOE	OAR-2003-0012-0600
Isotag Technology Inc.		OAR-2003-0012-0666, 0824 *
Isuzu		OAR-2003-0012-0809
Izaac Walton League of America [2]		
Kansas Farm Bureau	KFB	OAR-2003-0012-0825
Kinder-Morgan Energy Partners		OAR-2003-0012-0603
Komatsu		OAR-2003-0012-0455 – 0457
Kubota Corporation		OAR-2003-0012-0620
Laborers' Health and Safety Fund of N. America	LHSFNA	OAR-2003-0012-0638
Lister Petter		OAR-2003-0012-0155
Lubrizol		OAR-2003-0012-1019
Manufacturers of Emissions Controls Assoc.	MECA	OAR-2003-0012-0810 – 0811
Marathon Ashland Petroleum	MAP	OAR-2003-0012-0826 – 0827
Massachusetts Department of Env Protection	MA DEP	OAR-2003-0012-0641
Mercatus Center (George Mason Univ.)		OAR-2003-0012-0627, 0828 *
Michigan Farm Bureau	MFB	OAR-2003-0012-0625
The Motorcycle Industry Council	MIC	OAR-2003-0012-0685
The Mountaineers		OAR-2003-0012-0773
Murphy Oil Corporation		OAR-2003-0012-0212
National Association of Convenience Stores	NACS	OAR-2003-0012-0635
National Association of Home Builders [5]	NAHB	
National Association of Wheat Growers, et al	NAWG	OAR-2003-0012-0752

National Barley Growers Association	NBGA	OAR-2003-0012-0639
National Biodiesel Board	NBB	OAR-2003-0012-0776
National Corn Growers Association [6]	NCGA	
National Mining Association	NMA	OAR-2003-0012-0510
National Oilheat Research Alliance	NORA	OAR-2003-0012-0840
National Petrochemical and Refiners Assn.	NPRA	OAR-2003-0012-0814
Natural Resources Defense Council	NRDC	OAR-2003-0012-0661, 0665
Nebraska Farm Bureau Federation	NFBF	OAR-2003-0012-0514
New England Fuel Institute	NEFI	OAR-2003-0012-0712 – 0713
New Hampshire House of Representatives		OAR-2003-0012-0126
New York State Dept. of Environmental Conservation	NY DEC	OAR-2003-0012-0786
NYC Environmental Justice Alliance	NYCEJA	OAR-2003-0012-0583
NYC Office of Environmental Coordination	NYC OEC	OAR-2003-0012-0631
North American Equipment Dealers Assoc.	NAEDA	OAR-2003-0012-0647
Northeast States for Coordinated Air Usage Mgmt.	NESCAUM	OAR-2003-0012-0659
Octel Starreon LLC		OAR-2003-0012-0642
Ohio Environmental Council [2]	OEC	
Ohio-Michigan Equipment Dealers Association	OMEDA	OAR-2003-0012-0747
Oregon Department of Environmental Quality	OR DEQ	OAR-2003-0012-0779
Oregon Wheat Growers League	OWGL	OAR-2003-0012-0593
Pennsylvania Dept of Environmental Protection	PA DEP	OAR-2003-0012-0699
Petro Star Inc.		OAR-2003-0012-0624
Petroleum Marketers Association of America	PMAA	OAR-2003-0012-0606
Public Interest Research Group- various (also see 'US PIRG')	PIRG	OAR-2003-0012-0780
Regional Air Pollution Control Agency	RAPCA	OAR-2003-0012-0683
Salt Lake City- Mayor		OAR-2003-0012-0787
Salt Lake Clean Cities		OAR-2003-0012-0778
San Joaquin Valley Air Pollution Control District	SJVAPCD	OAR-2003-0012-0695
Sierra Club [1]		
Sinclair Oil Company		OAR-2003-0012-0704, 0829
Small Refiners		OAR-2003-0012-0754
Society of Ind Gasoline Marketers of America [7]	SIGMA	

South Coast Air Quality Management District	SCAQMD	OAR-2003-0012-0623
South Carolina Dept of Health & Environmental Control	SC DHEC	OAR-2003-0012-0476
Southern Alliance for Clean Energy [2]	SACE	
Southern Environmental Law Center [2]	SELC	
Stancil Co. (for Western Refining)		OAR-2003-0012-0843
State & Territorial Air Pollution Program Administrators	STAPPA	OAR-2003-0012-0507
Sunoco		OAR-2003-0012-0509
Tennessee Farm Bureau Federation	TFBF	OAR-2003-0012-0629
Tesoro		OAR-2003-0012-0662
Texas Commission on Environmental Quality	TCEQ	OAR-2003-0012-0716 – 0717
Texas House of Representatives		OAR-2003-0012-0658
ThermoKing Corporation		OAR-2003-0012-0406
Union of Concerned Scientists	UCS	OAR-2003-0012-0830
United Color Manufacturing	UCM	OAR-2003-0012-0501
US Custom Harvesters [6]		
US Public Interest Research Group [1]	US PIRG	
U.S Small Business Administration- Office of Advocacy	SBA; Advocacy	OAR-2003-0012-0815 – 0818
USA Rice Federation	USA Rice	OAR-2003-0012-0652
Valero Energy Corporation		OAR-2003-0012-0628
Western Business Roundtable	WBRT	OAR-2003-0012-0636
Western Regional Air Partnership	WRAP	OAR-2003-0012-0774 – 0775
Western States Air Resources Council	WESTAR	OAR-2003-0012-0711
Williams Energy Partners		OAR-2003-0012-0626
Wisconsin Department of Natural Resources	WI DNR	OAR-2003-0012-0702 – 0703
Wyoming Refining Company	WRC	OAR-2003-0012-0651
Yanmar Co, Ltd.		OAR-2003-0012-0615, 0813

1 - commented with NRDC
2 - commented w/ CATF
3 - commented w/ STAPPA
4 - commented with IWC
5 - commented with AGCA
6 - commented with NAWG
7 - commented with NACS
* inadvertently docketed twice; both numbers listed have the exact same comments

1. GENERAL POSITION STATEMENTS

What We Proposed:

The following comments relate in general to the NPRM. The comments in this section are not on any specific aspect of the proposed rule; rather, they are directed to the general substance of the proposal. More detailed proposal items, and their corresponding comments, can be found in later sections of this Summary and Analysis of Comments.

For more information on the proposed rule, see 68 FR 28328.

1.1 Supports Rule

1.1.1 Air Quality and Health Benefits

What Commenters Said:

A number of commenters expressed strong support for the proposed rule. These commenters cited the enormous air quality and health benefits that would result from its implementation and many described the air quality problems they have experienced personally and in their own communities, and referenced EPA's statistics on the number of premature deaths, hospitalizations, heart attacks, and asthma or respiratory-related health problems that could be avoided, as well as the costs associated with these illnesses. The commenters also cited the risks of both cancer and respiratory illness posed by diesel emissions. Lastly, commenters supported the adoption and implementation of this rule as quickly as possible without any weakening or delays in the proposal. Additional discussion on the specific health studies cited by commenters can be found in chapter 2.1.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 1-4
California Assemblymember Alan Lowenthal, OAR-2003-0012-0475 p. 1
Clean Air Council, OAR-2003-0012-0613 p. 1-2
Clean Air Task Force, et. al., OAR-2003-0012-0508 p. 1-8
Colorado Department of Public Health and Environment, OAR-2003-0012-0687 p. 1
Environmental Advocates of NY, OAR-2003-0012-0523 p. 1
Environmental Defense, OAR-2003-0012-0821 p. 1-7
Illinois Lieutenant Governor Pat Quinn, OAR-2003-0012-0781 p. 1-4
International Brotherhood of Teamsters, OAR-2003-0012-0664 p. 2
International Union of Operating Engineers, OAR-2003-0012-0600 p. 1-2
Laborer's Health and Safety Fund of North America, OAR-2003-0012-0638 p. 1
Mountaineers, OAR-2003-0012-0773 p. 1
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 1-7
NESCAUM, OAR-2003-0012-0659 p. 2-4
New York City Environmental Justice Alliance, OAR-2003-0012-0583 p. 1
New Hampshire House of Representatives, OAR-2003-0012-0126 p. 1
Pennsylvania Department of Environmental Protection, OAR-2003-0012-0699 p. 2
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 2-3

Salt Lake City, OAR-2003-0012-0787 p. 1
Salt Lake Clean Cities, OAR-2003-0012-0778 p. 1
Texas House of Representatives, OAR-2003-0012-0658 p. 1
U.S. Public Interest Research Group, OAR-2003-0012-0780 p. 1
Union of Concerned Scientists, OAR-2003-0012-0830 p. 1
Wisconsin Department of Natural Resources, OAR-2003-0012-0702, 0703 p. 1-2
100,334 Public Citizens
1,862 Public Citizens
New York Public Hearing
A-2001-28, IV-D-05 [6 public citizens; 9/11 EA p. 255; ALA p. 61, 108; CATF p. 234; E. Harlem AWG p. 269; ENE p. 251; Environmental Defense p. 147; FPIR p. 264; Mt Sinai COEM, p.241; NRDC p. 27; NY EJA p. 232; NY DEC p. 11; NY PIRG p. 126; Sierra Club p. 248; U.S. PIRG p. 185; W. Harlem EA p. 259]
Chicago Public Hearing
A-2001-28, IV-D-06 [35 public citizens; Advocate Healthcare p. 275; ALA p. 278; Beth El p. 300; BTI p. 264-269; CATF, 254; CAT p. 152-158; ELPC p. 249; IL EPA p. 227; IL HSC p. 190; NCBLRD p. 69; NRDC p. 304; OEC p. 290-292; STAPPA/ALAPCO p. 34; Sierra Club p. 122, 164; SACE p. 179; U.S. PIRG p. 9]
Los Angeles Public Hearing
A-2001-28, IV-D-07 [21 public citizens; ALA p. 171, 215; BTI p. 159; CARB p. 12; CA Earth Corps p. 201; CA ERA p. 77; CA Safe Schools p. 127; CAT p. 182; CCA p. 139; CSA p. 188; CBE p. 135; Environment CA p. 109; Environment Canada p. 167; Environmental Defense p. 87; LAF p. 250; LA IEC p. 197; NRDC p. 51; STAPPA/ALAPCO p. 22; Sierra Club p. 257; U.S. PIRG p. 175; UCS p. 65]

Many commenters stated that they believe that the proposed rule is a crucial component of the effort to meet health based air quality standards, such as the NAAQS, and improve visibility as required by the CAA and EPA's regional haze regulations. Some commenters (Oregon Department of Environmental Quality, WRAP, National Park Service) noted that this rule would especially help improve regional haze and visibility in the west. NESCAUM commented that attainment of the NAAQS is of immediate concern to the states in the northeast region. And SACE noted that emission reductions from nonroad sources would be particularly beneficial to metropolitan areas throughout the south. They added that many southern areas are struggling to address nonattainment designations that have resulted in part, from the tremendous growth this area has experienced. NRDC noted that L.A. is estimated to fall short of attainment by 183 tons of NO_x per day and the San Joaquin Valley faces a similar shortfall, they asserted that since nonroad engines will account for almost 50 percent of the vehicle-related NO_x emissions by 2007, and therefore it is crucial that EPA adopt this proposal as soon as possible. CARB noted that the CAA preempts California from controlling emissions from new farm and construction equipment under 175 hp, and that EPA action in this area is crucial in order to facilitate attainment with the standards. They added that 75 percent of the roughly 450,000 land-based and recreational marine diesel engines in California are in this category and constitute 21 percent and 58 percent of the total mobile source NO_x and diesel PM, respectively, in California. The Connecticut Department of Environmental Protection commented that in 1999, NO_x emissions from nonroad diesel engines alone were responsible for one-third of the total combined mobile and stationary source inventory in Connecticut, and as a result, this rule is crucial for assisting Connecticut in their efforts to attain and maintain the NAAQS for ozone. Environmental Defense provided additional discussion on this issue including an assessment of nonattainment areas throughout the nation and concludes that the problem could worsen without action to reduce nonroad emissions.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 1-4
City of Houston - Office of the Mayor, OAR-2003-0012-0630 p. 2
Connecticut Department of Environmental Protection, OAR-2003-0012-0653 p. 1-2
Environmental Defense, OAR-2003-0012-0821 p. 1-5
Massachusetts Department of Environmental Protection, OAR-2003-0012-0641 p. 1
New York City Office of Environmental Coordination, OAR-2003-0012-0631 p. 1
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 1-7
NESCAUM, OAR-2003-0012-0659 p. 2-4
Oregon Department of Environmental Quality, OAR-2003-0012-0779 p. 2
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 2-3
South Carolina Department of Health & Environmental Control, OAR-2003-0012-0476 p. 1
South Coast Air Quality Management District, OAR-2003-0012-0623 p. 1
Texas Commission on Environmental Quality, OAR-2003-0012-0716, 717 p. 1
Western Regional Air Partnership, OAR-2003-0012-0774, 0775 p. 1
Wisconsin Department of Natural Resources, OAR-2003-0012-0702, 703 p. 1-2
New York Public Hearing
A-2001-28, IV-D-05 [ALA p. 108; Environmental Defense p. 149]
Chicago Public Hearing
A-2001-28, IV-D-06 [IL EPA p. 228; NPS p. 207-212; OEC p. 292; SACE p. 179; WRAP p. 51]
Los Angeles Public Hearing
A-2001-28, IV-D-07 [CCA p. 141; Environmental Defense p. 88; NRDC p. 52; STAPPA/ALAPCO p. 25; SCAQMD p. 117; WRAP p. 157]

Some commenters (Clean Air Task Force, Pennsylvania Department of Environmental Protection, Wisconsin Department of Natural Resources, STAPPA/ALAPCO, and ENE) stated that the proposed rule is important because of the necessity for federal action in this area. They further noted that states are pre-empted from regulating standards from new engines and it is impractical for them to effectively regulate fuels and locomotives and marine engines at the state level. CARB also commented that almost 75 percent of the nonroad diesel engines in California are federally preempted and beyond CARB's authority to regulate.

We received comments regarding the potential for the rule to reduce the impact of diesel emissions on global warming. One commenter specifically cited the impact of black carbon from diesels as a major contributor to global warming, and added that states in the Northeast are increasingly looking to diesel emissions to reduce global warming emissions. (See additional discussion under Issue 2.2).

Letters:
Clean Air Task Force, et. al., OAR-2003-0012-0508 p. 7-8
Pennsylvania Department of Environmental Protection, OAR-2003-0012-0699 p. 2
Wisconsin Department of Natural Resources, OAR-2003-0012-0702, 0703 p. 1-2

New York Public Hearing, A-2001-28, IV-D-05 [ENE p. 251]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [STAPPA/ALAPCO p. 23]

A number of commenters expressed that the proposed rule would be important from an environmental justice perspective since it would help improve the health of those who are living near industrial areas or in urban areas where construction is often ongoing. They commented that it is important to recognize this proposal as a viable and necessary step for alleviating the disproportionate adverse environmental effects on minority and low-income communities. The commenters further added that these regulations could save 1 to 2 percent of hospital care costs among certain susceptible populations, such as people of color and low-income families. Environmental Defense specifically noted that when information from the MATES II study is matched with 1990 Census Data, it is clear that the communities most impacted by diesel exhaust and other air toxics are predominantly low-income communities of color. They provided additional information on the income, employment, and race of affected communities and cites to 1990 Census Data, William H. Webster and Hubert Williams, The City in Crisis: A Report by the Special Advisor to the Board of Police Commissioners on the Civil Disorder in Los Angeles (1992), reprinted in Robert Garcia, Riots & Rebellion (1997), as supporting documentation.

In Illinois, locomotives are quite prevalent especially in the urban area in and around Chicago. It is in urban areas that the risk of cancer and asthma is highest.

Letters:
Environmental Defense , OAR-2003-0012-0821 p. 6-7
IL Lt. Governor Pat Quinn, p. 4
NESCAUM, OAR-2003-0012-0659 p. 2-4
New York Public Hearing, A-2001-28, IV-D-05 [NY PIRG p. 126]
Los Angeles Public Hearing
A-2001-28, IV-D-07 [CEC p. 205; CA ERA p. 77; CCA p. 141; CSE p. 189; CBE p. 135; LAF p. 250; L.A. IEC p. 198; Sierra Club p. 269; UCS p. 65]

Some commenters noted that the effects of nonroad diesel emissions on fragile ecosystems is well documented- these emissions produce, among other ecological problems, acid rain. They further stated that as the acidity of an aquatic ecosystem increases, species of plant and animal life are diminished, and terrestrial animals dependent on aquatic ecosystems are also affected. The Illinois Department of Natural Resources noted that acid rain reduces productivity in commercial fisheries, forestry and agriculture resulting in a loss of jobs and taxable revenue in the State of Illinois. The Air Resources Division of the National Park Service noted that researchers have documented the air pollution effects on biological and aquatic resources in our national parks and that control of nonroad diesel pollution is a crucial component of mitigating these effects.

Environmental Defense and STAPPA/ALAPCO commented that they support the implementation of the proposed rule since the resulting NO_x and PM emission reductions will lead to significant economic benefits in the form of reduced damage to crops. Environmental Defense further noted that California farmers lost an estimated $333 million to ozone crop damage in 1984 and $265 million in 1989. They commented that they believe that controlling NO_x emissions from diesel farm equipment will reduce ozone formation and will help limit crop damage, and cited a recent study which demonstrated that farm workers are adversely affected by the pollution from diesel farm equipment and have much to gain from rigorous emission standards.

Letters:
Clean Air Task Force, et. al., OAR-2003-0012-0508 p. 7
Environmental Defense, OAR-2003-0012-0821 p. 3
Illinois Lieutenant Governor Pat Quinn, OAR-2003-0012-0781 p. 1-4
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 1-7
Pennsylvania Department of Environmental Protection, OAR-2003-0012-0699 p. 2
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 2
Wisconsin Department of Natural Resources, OAR-2003-0012-0702, 0703 p. 1-2
New York Public Hearing, A-2001-28, IV-D-05 [Environmental Defense p. 149]
Chicago Public Hearing
A-2001-28, IV-D-06 [IL DNR p. 120; NPS p. 211; Sierra Club p. 122]
Los Angeles Public Hearing
A-2001-28, IV-D-07 [Environmental Defense p. 89; STAPPA/ALAPCO p. 23]

Our Response:

We appreciate the comments that these commenters provided. We believe that reducing emissions from nonroad sources is critically important to achieving such large improvements. The systems approach of this program- setting standards for nonroad diesel fuel sulfur as well as engine emissions standards- will facilitate great pollutant emission reductions from this sector. With expected growth in the nonroad sector, the relative emissions contribution from nonroad diesel engines without today's final rule is projected to be approximately 44% of the $PM_{2.5}$ and 47% of the NOx emissions from all mobile sources in 2030. Today's action will achieve engine emissions reductions in PM and NOx emissions levels in excess of 90%, and will reduce sulfur levels in NRLM diesel fuel more than 99% to 15 ppm. We note that we are finalizing this program on the same time frame as we proposed in the NPRM.

We agree with the commenters that the requirements in this rule will result in substantial benefits to public health and welfare through significant reductions in NOx and PM, as well as NMHC, CO, SO_2 and air toxics. Diesel exhaust is of specific concern because it has been judged to likely pose a lung cancer hazard for humans as well as a hazard from noncancer respiratory effects. We estimate these annual emission reductions will prevent 12,000 premature deaths, 15,000 nonfatal heart attacks, and over 5 million lost work days from respiratory symptoms. In addition, emissions from these engines contribute greatly to a number of serious air pollution problems and would continue to do so in the future absent further reduction measures. Ozone, NOx, and PM also cause significant public welfare harm such as damage to crops, eutrophication, regional haze, and soiling of building materials.

We also agree with commenters that emissions from nonroad engines account for substantial portions of the country's ambient PM and NOx levels. We estimate that these engines account for about ten percent of total NOx emissions and about ten percent of total direct PM emissions. These proportions are even higher in some urban areas, which include many poorer neighborhoods, and can be disproportionately impacted by diesel emissions. These areas will greatly benefit from the adopted emissions controls.

1.1.2 Impact on States

What Commenters Said:

The Colorado Department of Public Health and Environment and the Western States Air Resources Council commented that harmonization of diesel fuel standards for on and off road will ultimately eliminate the potential air quality impacts of misfueling and will ease transport and storage issues in the petroleum industry.

We also received comments from CARB, OTC, Environment Northeast, and the Texas Commission on Environmental Quality, which stated that the proposed rule is important because of the necessity for federal action in this area. These commenters further noted that States are pre-empted from regulating standards from new engines and it is impractical for them to effectively regulate fuels and locomotives and marine engines at the state level. CARB specifically commented that almost 75 percent of the nonroad diesel engines in California are federally preempted and beyond CARB's authority to regulate.

Letters:
Colorado Department of Public Health and Environment, OAR-2003-0012-0687 p. 1
Texas Commission on Environmental Quality, OAR-2003-0012-0716, 717 p. 1
Western States Air Resources Council, OAR-2003-0012-0711 p. 1
New York Public Hearing, A-2001-28, IV-D-05 [ENE p. 251; OTC p. 209]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [CARB p. 12]

Our Response:

As noted in the sections above, we received many comments from states that were very supportive of the rule.

In regard to the comments from Colorado and WESTAR, we note that the fuel program that we are finalizing today will lead to harmonization of highway and nonroad fuels in the future. In addition, the designate and track provisions that we are finalizing will help to alleviate concerns with misfueling and the transportation and storage of fuels (see section IV of the rule preamble for more information on the fuel program).

We appreciate the comments acknowledging the importance of today's action.

1.2 Opposes Rule

What Commenters Said:

Rule is too stringent

Three private citizens commented that they do not support the implementation of the proposed rule because there is no need for additional government regulations in the nonroad sector. Two of these commenters specifically noted that emission reductions from nonroad engines are not necessary since existing engines are already clean enough and are not significant contributors to overall PM and NOx emissions, summertime ozone levels, acid rain, or water pollution. In addition, they stated, these engines are often operated far from areas with larger or more concentrated populations. *[See related discussion under Issues 5.3.3 and 7.1.]*

The third commenter noted that newer equipment will have larger engines, but the trend towards fewer, larger, and more efficient farms, less power equipment will be needed to perform the same tasks. The commenter also stated that this is evidenced by falling tractor and combine sales in the U.S., which along with the low number of sources and operations in relatively rural areas, precludes the need for additional regulations aimed at reducing emissions in the nonroad sector.

<u>Rule is too costly</u>

Three private citizens commented that they do not support the implementation of the proposed rule because it would be too costly. These commenters believed that the proposed rule would likely unnecessarily increase the cost of equipment, maintenance, and repair. They further stated that the proposed standards will cost resource providers millions with no tangible benefit to public health. One commenter specifically requested that EPA listen to industry concerns in this regard. Another commenter suggested that in lieu of finalizing the proposed rule, which could prove to be too costly, EPA should provide tax incentives for heavy equipment manufacturers that would lead to voluntary emission reductions. *[See related discussion under Issues 5.3.3 and 7.1]*

<u>Rule is too lenient</u>

Over 80,000 public commenters stated that they support the rule, but are opposed to the timing and the possibility of only regulating locomotive and marine fuel to 500 ppm. These commenters believe that the rule should be implemented on a more accelerated time schedule (they do not support providing lead time for the manufacturing and fuel industries). Further, these commenters believe that all diesel fuel- including locomotive and marine fuel- should be reduced to a sulfur content of 15 ppm.

<u>Letters:</u>
3 Public Citizens
80,000+ Public Citizens

Our Response:

As described above in section 1.1.1, we continue to believe that the program that we are finalizing today is necessary, and is technologically and economically feasible in the time frame allowed. We also believe that the lead time being offered is necessary for the manufacturing and fuel industries to be able to comply with the rule. The benefits of this action, with overall quantifiable benefits totaling over $83 billion annually by 2030, will greatly outweigh the costs. For a more in-depth description of the feasibility of the engine and equipment and fuel standards, please refer to chapters 4 and 5, respectively, of the Regulatory Impact Analysis (RIA). In addition, chapters 6 and 7 of the RIA describe the costs of the rulemaking in greater detail.

2. ENVIRONMENTAL AND AIR QUALITY ISSUES

What We Proposed:

The comments in this section correspond to Sections I and II of the nonroad Tier 4 proposal, and therefore are targeted at environmental and air quality issues from the proposal. A summary of the comments received, as well as our response to those comments are located below. Please note that comments addressing environmental or public health benefits in the context of EPA's benefit-cost analysis, will be included in Section 7.1 of this Summary and Analysis (which corresponds to Section V.E of the preamble).

For the full text of comments summarized here, please refer to the public record for this rulemaking.

2.1 General Public Health Impacts

2.1.1 Reducing Diesel Emissions Is Essential for Protecting the Public Against Health Risks

What Commenters Said:

We received many comments that noted that the emission reductions that would result from the implementation of the proposed rule would lead to significant reductions in cases of cancer. The commenters also cited to a variety of reports and agreed that the science to date supports the conclusion that there is a correlation between diesel emissions and cancer. NRDC noted that many leading agencies around the world have concluded that diesel emissions pose some form of cancer risk, including EPA, and the World Health Organization's cancer research office. This commenter also noted that diesel soot pollution is particularly significant for Californians since both the South Coast Air Quality Management District and CARB concluded that diesel pollution is responsible for more than 70 percent of the cancer risk in California. In addition, STAPPA/ALAPCO have ranked L.A. number 1 and San Francisco number 3 in total cancer cases expected over the next 70 years. NRDC cited to and attached as supporting documentation: Solomon, Gina, M.D., "Health Effects of Diesel Exhaust," Clinics in Occupational and Environmental Medicine, 2003; and cited to the ALA/Environmental Defense report entitled "Closing the Divide," April 2003, and provided a web site reference for this report. Environmental Defense noted that in L.A. County, 86 percent of the cancer risk from all air pollutants is due to diesel mobile sources such as construction equipment. This commenter provided as supporting documentation, a history of determinations of the carcinogenicity of diesel exhaust and a list of toxic air contaminants and hazardous air pollutants found in diesel exhaust in Appendices A and B of their letter, respectively. Another commenter (U.S. PIRG) noted that a 2002 report by Illinois PIRG found that the average cancer risk from diesel exhaust in Illinois exceeds EPA's health protective threshold for cancer by more than 425 times and 63 percent of that additional cancer risk comes from the diesel equipment that will be regulated under the proposed rule. This commenter added that a recent study showed that in Chicago, diesel equipment produced more than 40 percent of the soot and 25 percent of the smog pollutants from all vehicles. U.S PIRG also cited to their 2002 analysis of EPA's National Scale Air Toxics Assessment, which suggests that diesel exhaust comprises a significant portion of the cancer risk from air toxics nationwide. Some commenters (CATF, NCBL, Dorvich, Environmental Defense) also cited components of diesel fuel emissions that are considered to be probable human carcinogens and noted that reductions in diesel emissions would also reduce the cancer rate. One of these commenters (Dorvich) noted that after taking into account factors like age, smoking, and occupational exposure, diesel emissions have been linked to about a 40 percent increase in the risk of cancer. Some commenters (Environmental Defense, CCA, Miller, Carson, Sierra Club) also cited to the Multiple Air Toxics Exposure Study (MATES) II, which found that diesel particulate emissions are responsible for 70 percent of the cancer risk associated with air pollution in California's South Coast region. One of these commenters (Sierra Club) also provided additional data summarizing the amount of cancer-causing substances released nationwide, statewide in Wisconsin, and in specific counties within Wisconsin for both nonroad and onroad mobile sources in terms of percent contribution and pounds released. NESCAUM noted that the National Toxics Inventory data (1996) indicate that diesels contribute up to 60 percent of the mobile source inventory of formaldehyde and acetaldehyde in the Northeast, which contributes to the elevated cancer risk in this region. The Building and Construction Trades Department cited to research conducted by the Construction Occupational Health Program (COHP) at the University of Massachusetts, which shows that a significant percentage of workers are exposed to diesel pollution that exceeds threshold values, thus posing a health risk to these individuals. The LHSFNA commented that health concerns to diesel exhaust spurred the Mine Safety and Health Administration to propose rules to reduce the risks to miners of serious health hazards that are associated with exposure to high concentrations of diesel PM. MSHA stated that "The best available evidence indicates that such high exposures put these miners at excess risk of a variety of adverse health effects, including lung cancer. Many commenters provided testimony and comments that generally addressed the risk of cancer in the context of their support for the proposed nonroad diesel rule. See also Issue 1.1.1.

Letters:
NESCAUM, OAR-2003-0012-0659 p. 3-4
Clean Air Task Force, et. al., OAR-2003-0012-0508 p. 1-8
Environmental Defense, OAR-2003-0012-0821 p. 1-6, 21-22
Illinois Lieutenant Governor Pat Quinn, OAR-2003-0012-0781 p. 1-4
Laborer's Health and Safety Fund of North America, OAR-2003-0012-0638 p. 1-2
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 7-13
Building and Construction Trades Dept., AFL-CIO, OAR-2003-0012-0674-0676 p. 2-3
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 3-8
South Coast Air Quality Management District, OAR-2003-0012-0623 p. 2
U.S. Public Interest Research Group, OAR-2003-0012-0780 p. 1-2
Wisconsin Department of Natural Resources, OAR-2003-0012-0702, 0703 p. 2
Sierra Club - Chicago (IV-D-742) p. +2-3
New York Public Hearing
A-2001-28, IV-D-05 [ALA p. 109; CATF p. 234; NRDC p. 28; STAPPA/ALAPCO p. 39; U.S. PIRG p. 186]
Chicago Public Hearing
A-2001-28, IV-D-06 [1 public citizen p. 280; CATF p. 254; NCBLRD p. 70; Sierra Club p. 122; U.S. PIRG p. 11]
Los Angeles Public Hearing
A-2001-28, IV-D-07 [2 public citizens p. 63, 242; ALA- CA p. 172; ALA-LA 218; CEC p. 203; CCA p. 147; CSE p. 193; ED p. 88; LAF p. 249; NRDC p. 53; Sierra Club p. 258; U.S. PIRG p. 176]

NESCAUM, NRDC, STAPPA/ALAPCO cited to and summarized the interim results of a study just conducted by NESCAUM on nonroad equipment and operator exposure to PM 2.5 and such toxics as formaldehyde (see Evaluating the Occupational and Environmental Impacts of Nonroad Diesel Equipment in the Northeast, Interim Report, June 9, 2003). This study showed that in all industrial locations sampled, diesel activity substantially increased fine particulate matter and toxic exposure for workers and nearby residents, in some cases by as much as 16 times. Measured concentrations of acetaldehyde, benzene, and formaldehyde around the tested nonroad equipment operations were as much as 140 times the federally-established screening threshold for cancer risks. NESCAUM summarized some of the conclusions included in the report and provided a copy of their report, which included additional discussion and supporting data.

Letters:
NESCAUM, OAR-2003-0012-0659 p. 3-4
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 7-13
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 3-8
New York Public Hearing, A-2001-28, IV-D-05 [NESCAUM p. 94]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [U.S. PIRG p. 177]

A number of commenters commented that nonroad diesel engines emit huge quantities of particulate matter and other pollutants that trigger asthma attacks, bronchitis, emphysema, and other ailments that can lead to premature death. Some commenters provided specific numbers regarding adverse health effects that could be avoided through the implementation of this rule. For example, some commenters (CATF, CCA, NRDC) noted that the proposed rule will cut more than 9,600 premature deaths and prevent more than 260,000 respiratory symptoms in children, 5,700 children's asthma-related hospital emergency room visits, 16,000 heart attacks, and almost 1 million lost work days annually. NRDC cited to and attached as supporting documentation: Solomon, Gina, M.D., "Health Effects of Diesel Exhaust," Clinics in Occupational and Environmental Medicine, 2003; and cited to the ALA/Environmental Defense report entitled "Closing the Divide," April 2003, and provided a web site reference for this report. STAPPA/ALAPCO noted that the proposed rule will prevent annually 8,500 premature deaths, 180,000 asthma attacks, 5,600 cases of adult chronic bronchitis, 18,000 cases of acute chronic bronchitis in children, nearly 200,000 cases of lower respiratory symptoms in children, 6,000 hospital admissions, and 1.5 million lost work days. The Coalition for Clean Air also cited the USC Keck School of Medicine study, which found that the health of children growing up in southern California was directly impaired by NO_x and PM emissions and that their lung function was reduced by 10 percent. Environmental Defense cited a four year study summarized in a 2002 article from the American Journal of Respiratory and Critical Care Medicine, which shows that children in L.A. suffer significant deficits in lung-growth function due to exposure to NO_x, PM, and elemental carbon. Environment Northeast cited a Hartford Health survey, which revealed that 15 percent of adults and 8.7 percent of school-age children have asthma. This commenter also noted that a recent survey of children visiting primary care facilities in Hartford, CT found that 33 percent of these children have asthma. The Sierra Club noted that there would be significant benefits from reducing nonroad emissions from construction equipment to city residents and the construction workers. The National Coalition of Black Lung and Respiratory Disease noted that particulates exacerbate medical conditions for patients who already have impaired lung function. One commenter (Dr. Pandya) cited to his article as published in 2002 in Environmental Health Perspectives, which examines the impact of diesel exhaust on asthma. ALA cited to their report "The American Lung Association State of the Air 2003" which estimates that nearly 2 million children with asthma live in counties that violate the NAAQS. Many commenters provided testimony and comments that generally addressed these risks to public health. See also Issue 1.1.1.

Letters:
Clean Air Council, OAR-2003-0012-0613 p. 1-2
Clean Air Task Force, et. al., OAR-2003-0012-0508 p. 1-8
Environmental Defense, OAR-2003-0012-0821 p. 1-6
Illinois Lieutenant Governor Pat Quinn, OAR-2003-0012-0781 p. 1-4
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 7-13
NESCAUM, OAR-2003-0012-0659 p. 2-4
New York City Environmental Justice Alliance, OAR-2003-0012-0583 p. 1
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 2-3
New York Public Hearing
A-2001-28, IV-D-05 [1 public citizen, p. 166; ALA p. 108; ALA-NY p. 62; CATF p. 234; ED p. 148; E. Harlem AWG p. 270; E NE p. 251; Mt. Sinai COEM p. 241; NRDC p. 28; NYC EJA p. 231; STAPPA/ALAPCO p. 39; Sierra Club p. 249; W. Harlem EA p. 259]
Chicago Public Hearing, A-2001-28, IV-D-06 [NCBLRD p. 70]
Los Angeles Public Hearing
A-2001-28, IV-D-07 [1 public citizen, p. 229; ALA- CA p. 172; ALA-LA p. 216; CCA p. 146; CSE p. 188; ED p. 88; NRDC p. 53]

Environmental Defense and West Harlem Environmental Action commented that EPA's rule is particularly important from an environmental justice perspective- diesel exhaust has long been a problem in urban communities of color. West Harlem also noted that New York has some of the highest rates in the nation of childhood asthma hospitalization. The commenter added that East Harlem has long led the country with the highest rates, roughly five times the national average and that recent findings indicate that a staggering one in four children in Central Harlem suffer from asthma, four times the national average. Communities for a Better Environment noted that the residents of Wilmington, California, 80 percent of whom are Latino, are significantly impacted by diesel pollutants, and often have difficulty communicating with regulators on the issue of reducing pollution. Environmental Defense noted that over 80 percent of the communities impacted by air toxics emissions are African-American and Latino with a significant percentage of those living below the poverty line. The proposed standards would have a direct positive impact on human health and the cancer risk in these communities.

Letters:
New York Public Hearing, A-2001-28, IV-D-05 [W. Harlem EA p. 259]
Los Angeles Public Hearing
A-2001-28, IV-D-07 [CBE p. 134; Environmental Defense p. 92]

The health benefits of the proposed rule will exceed those of other recent vehicle-related programs. NRDC provided significant discussion and supporting documentation to support their claim, including detailed tables that summarize the cases per year of PM-related adverse health effects that will be avoided and the monetary and non-monetary health and environmental benefits.

Letters:
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 7-13

Our Response:

We agree that there are public health benefits from the final Nonroad Diesel rule as described in Chapter 2 of the RIA. The final rule will reduce harmful emissions and protect sensitive groups such as outdoor workers, children, asthmatics and those with existing heart and lung disease.

We agree that diesel exhaust is a likely human carcinogen, and our *Health Assessment Document for Diesel Engine Exhaust* (Diesel HAD) provides substantial evidence to support this claim.[1] We also agree that diesel engines comprise a large portion of the national emissions inventory for some specific air toxics such as formaldehyde. The Agency recognizes that in some occupations, exposures to diesel exhaust are of concern.

We have reviewed the documents cited that provide a numerical estimate of cancer risk attributable to diesel exhaust. The Agency does not believe that at this time the data support a confident determination of a unit risk for diesel exhaust and therefore the cancer-related mortality or morbidity associated with diesel exhaust exposure cannot be determined quantitatively. However, the Agency has determined that the carcinogenic risk from diesel exhaust may be as high as 10^{-3} to 10^{-5} but a zero risk cannot be ruled out. The basis for these determinations is provided in Chapters 8 and 9 of the Diesel HAD.

We concur with the commenter's statements regarding the composition and biological fate of diesel exhaust particles.

We have reviewed the interim and final report from NESCAUM and agree that exposures to hazardous air pollutants in diesel-associated professions and nearby residential areas can be elevated.

We agree that reducing nonroad diesel engine emissions will reduce exposures to air toxics and criteria pollutants in low-income and minority populations. We agree that the rule will benefit environmental justice. We agree in general with the importance of receiving comments from communities who perceive problems related to diesel-related pollution.

We agree in general with comments supporting the rule due to adverse health effects from exposure to pollutants such as particulate matter associated with nonroad diesel engines. We agree in general that the rule provides a health-related benefits associated with a range of health outcomes.

2.1.2 Uncertainty in Health Risks Associated with Diesel Engines

What Commenters Said:

DDC and EMA commented that there is uncertainty in our estimates of the health risks associated with diesel engines, and that EPA should reevaluate the effects of diesel exhaust since old studies of diesel exhaust from prior decades are not relevant to Tier 4-type engine products. The commenters also

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

stated that the proposed Advanced Collaborative Emissions Study (ACES) initiative, which EMA is spearheading, will yield key data in this regard; and that EPA should commit itself and its resources to the ACES project.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 8
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 93

API and Marathon commented that the specific components of diesel exhaust that significantly contribute to health risk are currently not adequately defined. The concentrations of emissions associated with diesel exhaust have been at concentrations greater than those found in ambient air and it is unclear whether the rat carcinogenicity observed experimentally at high concentrations decreases in a linear fashion as related to dose, or if there is a practical threshold below which additional health benefits are unlikely. The uncertainty associated with the dose-response curve confounds the use of existing carcinogenicity data for quantitative risk/benefit assessment. The commenters cited to two independent expert review panels that have recognized the non-quantitative aspect of the relationship of diesel exhaust to increased risk of lung cancer. These are: 1) Health Effects Institute (1999), Diesel Emissions and Lung Cancer: Epidemiology and Quantitative Risk Assessment (www.healtheffects.org), and 2) Clean Air Scientific Advisory Committee (CASAC) of EPA's Scientific Advisory Board, Review of the EPA Health Assessment Document for Diesel Emissions (EPA 600/8-90/057D and EPA600/8-90/057E).

API and Marathon further commented that EPA continues to overstate the certainty that PM alone is causing mortality and morbidity. In 1998, the NAS recommended a comprehensive long term research program to evaluate the health effects of PM. While some new data has been provided as a result of this study, additional data are needed. API also noted that they have previously submitted significant comment on EPA's PM health risk assessments, continues to express concern that the current database does not allow for an accurate overall assessment of the human health or environmental effects, and concludes that EPA has not provided a complete or balanced health effects review and has overestimated the benefits of reducing ambient levels of PM.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 46-47
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 42-43

Our Response:

As discussed in Chapter 2 of the RIA, the diesel health studies in the *Health Assessment Document for Diesel Engine Exhaust* and, published subsequently, are relevant to the types of engines currently in use in the Nonroad fleet. These engines are very durable and are often in the fleet for over 20 years. Further, the emissions from on-road diesel engines are similar to those from nonroad diesel engines. These studies and exposure assessments such as the National-Scale Air Toxics Assessment (NATA) demonstrate a need to reduce current diesel exhaust.

As stated in the *Health Assessment Document for Diesel Engine Exhaust*, we agree in general of the need to evaluate the health effects of diesel exhaust from future technology diesel engines. We fully support the ACES research program and are spending considerable staff time to help implement this work.

In response to API and Marathon's comments, we concur that, at present, there are insufficient data to derive a dose-response curve for diesel exhaust. As described in the *Health Assessment Document for Diesel Engine Exhaust*, and based on Clean Air Science Advisory Committee (CASAC) advice, we do not present a cancer incidence estimate. Similarly, cancer incidence related exclusively to diesel exhaust PM is not a part of EPA's quantitative economic benefits methodology. We refer to the *Health Assessment Document for Diesel Engine Exhaust* for a more detailed discussion of the limitations of the current health studies specific to diesel exhaust and, also, a discussion of a range of carcinogenic risk that may be associated with diesel exhaust based on numerous epidemiology studies.

Regarding API and Marathon's comments that we are overstating the current state of knowledge regarding PM health effects, we do not agree. During the review of the PM NAAQS that was completed in 1997, EPA concluded that PM, alone or in combination with other pollutants, is associated wtih adverse effects below those allowed by the then-current standards. EPA has reviewed the substantial literature on this topic and believes that health and welfare effects do result from levels of $PM_{2.5}$ observed in ambient air. The Fourth External Review Draft of Air Quality Criteria for Particulate Matter expresses EPA's current understanding of PM health effects, as reflected in the 1996 PMCD and in subsequently published literature. The document is currently under review by CASAC. We have modeled air quality related to a preliminary control option as illustration. The emission differences between that modeling and the final rule impacts are discussed in RIA Chapter 3.6.

We agree with the commenter on the importance of further PM-related research, suggested in the NRC's reports on PM research.

The Agency recognizes that estimates of PM-related health effects are subject to uncertainty related to different steps of the analytical (modeling) process. In response to comments from both the NAS and the SAB's Health Effects Subcommittee (SAB-HES) regarding economic benefits, as well as various public commenters, the Agency has initiated the development of an integrated strategy to characterize uncertainty in its benefits estimates. This approach will consider the entire analytical framework used in quantifying benefits and will focus in on those elements that contribute most significantly to uncertainty in those estimates. As soon as elements of this strategy are finalized, we will apply them in order to characterize uncertainty in our benefits estimates. It is also important to note that, while the NAS highlighted the need for quantitative characterization of uncertainty associated with benefits estimates, it also stated that the presence of uncertainty in benefits estimates should not delay action taken to promote or protect public health.

In addition to developing methods for characterizing uncertainty, we have continued to update our benefits analysis methodology to reflect advances in the state of knowledge and understanding regarding specific pollutants. For this rule, we have made the following key updates to the PM modeling approach (all of which have been recommended by the SAB-HES): (a) use of the Pope, 2002 reanalysis of the ACS study data as the basis for modeling chronic exposure-related mortality, (b) incorporation of updated impact functions to reflect updated time-series studies of hospital admissions to correct for errors in application of the generalized additive model (GAM) functions in S-plus; (c) inclusion of infant mortality in the primary analysis, and (d) incorporation of asthma exacerbations into the primary analysis.

2.1.3 Health Benefits of the Rule and Current Air Pollution Problems

What Commenters Said:

The Mercatus Center commented that EPA overestimated the probable health benefits of the rule and current air pollution problems. The vast majority of the health benefits EPA claims for the proposed rule are unlikely to be realized because EPA has greatly overestimated the health damage caused by current air pollution trends. EPA did not accurately characterize the impact of long-term and short-term exposure to PM or the overall impact of ozone on public health. EPA has not provided the public with an accurate assessment of the weight of the evidence on the health effects of current air pollution, since 1) there are numerous inaccuracies in the studies upon which EPA has relied to conclude that there is a significant risk to the public; 2) EPA relies only on those studies that support its conclusion and does not evaluate or discuss studies that would show otherwise; and 3) overestimates the number of people who are exposed to, or are at risk from, elevated air pollution. Commenter (Mercatus) provides significant additional discussion and supporting documentation and data to support their position on this issue, including a critique of the studies upon which EPA has relied (such as the ACS and Six Cities studies) and suggestions for additional studies that should be taken into consideration. (See additional discussion under Issue 2.1).

The National Association of Wheat Growers pointed out that there are no areas of the county out of attainment for NO2. Given that reductions in NOx are a primary goal of the proposed regulation, EPA is vigorously attacking a problem which does not exist.

Letters:
Mercatus Center, OAR-2003-0012-0627, 0828 p. 12-29
National Association of Wheat Growers et al, OAR-2003-0012-0752 p. 2

Our Response:

We disagree with the comments. Through the development of criteria documents for ozone, SO_2 and PM and the *Health Assessment Document for Diesel Engine Exhaust* (Diesel HAD), we have carefully reviewed the science in public forums with expert and public review. We are relying on those documents in our interpretations of the science.

For example, in the criteria document for PM, after evaluating all the relevant studies (positive and negative and neutral), EPA concludes the following:

> “A growing body of epidemiology studies confirm associations between short- and long-term ambient $PM_{2.5}$ exposures (inferred from stationary air monitor measures) and adverse health effects and suggest that $PM_{2.5}$ (or one or more $PM_{2.5}$ components) is a probable contributing cause of observed PM-associated health effects.” P 8-276, conclusion #2

We believe that we have taken the most appropriate, peer-reviewed approach to characterizing long-term and short-term effects of air pollution on public health. This document is not meant as a “weight of evidence” of current air pollution science, but rather a highlight of the key scientific issues as defined in EPA’s criteria documents. These criteria documents and the Diesel HAD lay out the current science on the criteria air pollutants and diesel exhaust. These documents have been subject to peer review by the Clean Air Scientific Advisory Committee (CASAC). Also, several key PM health studies have been independently reviewed by the Health Effects Institute which affirmed EPA’s conlcusions.

In the criteria documents, we have evaluated all relevant scientific data from a variety of relevant disciplines. In these processes, we did take into consideration the studies and issues mentioned in the comments. As discussed in the criteria documents, we agree that there remain some uncertainties, and that further research is needed.

In Chapter 2 of the RIA, we present an analysis of measured air quality data (that has been quality assured, certified, and that is complete). As described in detail in the technical support document, we list counties with a monitored PM design value (based on 3 years of complete data) that violates the standard. We then report the associated population. We have also included information about the recently designated 8-hour nonattainment areas. We agree that not every person in the county or nonattainment area would experience exactly the concentration at the central monitor. It is possible, based on activity patterns, that the exposures to PM could be higher or lower. For example, we received public comment (e.g., NESCAUM) that exposures near Nonroad Diesel equipment and residences near construction sites where this equipment is operated, can be significantly higher than central site monitors. Furthermore, in Chapter 2 we summarize NATA modeling that takes into account people's activity patterns and presents exposure to diesel PM and other toxics from all sources, including nonroad diesel equipment.

In addition, the methodology used to conduct the economic benefits analysis reflects recommendations provided by both the NAS and SAB-HES regarding specific elements of the analytical framework design. Consequently, the Agency believes that the methods used in this analysis reflect the latest science regarding health effects incidence estimation and valuation for ozone and PM. The analytical framework used in this benefits analysis is based on the methodology developed by the Agency to conduct the cost-benefit analysis for the Clean Air Act (the 812 Analysis). The analytical blueprint for the 812 Analysis has been subjected to a rigorous peer-review by the SAB-HES which focused on key elements of the framework including the selection of epidemiological studies as the basis for modeling morbidity and mortality. Based on guidance provided by the SAB-HES and the NAS, the EPA has updated the benefits analysis methodology used for the NRD Final Rule Making effort to reflect the latest science regarding PM and ozone health incidence estimation and valuation. Specific modifications include: (a) use of the Pope 2002 reanalysis of the ACS study data as the basis for the primary mortality estimate, (b) incorporation of child mortality into the primary estimate, (c) incorporation of asthma exacerbations into the primary estimate and (d) the use of updated time-series data for morbidity that reflects corrections for GAM-related errors introduced in previous analyses of several key data sets. These improvements in the benefits analysis methodology for PM reflect the Agency's ongoing effort to maintain the scientific defensibility of benefits estimates generated in support of regulatory analysis.

Finally, in response to the comment from The National Association of Wheat Growers, our new NOx standards for nonroad engines are primarily intended to mitigate ambient concentrations of ozone, because ozone formation in the atmosphere is directly linked to the concentration of NOx. Although exceedence of National Ambient Air Quality Standards for NOx may not be a problem, it continues to be a significant problem for ozone.

2.2 Issues Related to Specific Public Health or Exposure Studies

2.2.1 Long-term Exposure to PM and Diesel Exhaust and Health Effects

2.2.1.1 EPA Should Consider Specific Studies

2.2.1.1.1 Veteran's Study

What Commenters Said:

The Mercatus Center commented that EPA should rely on the Veteran's Study as cited in the RIA, as a more accurate test of the effects of PM exposure on long-term health The Veterans Study reports a statistically significant decrease in mortality associated with $PM_{2.5}$. However, the study population included men with preexisting high blood pressure, which should have made them more susceptible to the effects of PM than the comparatively healthy populations of the ACS and Six Cities studies. There may be some residual confounding that may explain the anti-correlation between $PM_{2.5}$ and health. Nevertheless, this study's statistical analysis of individual health factors is more comprehensive than that of the ACS or Six Cities studies because it includes other non-pollution health factors such as age, smoking-status, blood pressure, and body-mass index.

Mercatus further added that EPA should include the Veterans Study in its health effects analysis; noting that EPA cited to the Veterans Study in the Cost-Benefit section of the RIA (Chapter 9), but did not discuss this study in the section on health effects of air pollution (Chapter 2).

Letters:
Mercatus Center, OAR-2003-0012-0627, 0828 p. 16-18

Our Response:

We do not agree that the Veterans Study provides a better estimate of $PM_{2.5}$-related health effects.[2] Unlike previous long-term analyses, this study found some associations between premature mortality and ozone but found inconsistent results for PM indicators. We note that, while the PM analyses considering segmented (shorter) time periods gave differing results (including significantly negative mortality coefficients for some PM metrics), when methods consistent with the past studies were used (i.e., many- year average PM concentrations), similar results were reported: the authors found that "(t)he single-mortality-period responses without ecological variables are qualitatively similar to what has been reported before (SO4 $\geq$ PM2.5 > PM15)." First, the Veteran's study assessed male veterans with elevated blood pressure, who had a higher than average proportion of current and former smokers. The population is not sufficiently similar to the general U.S. population to allow for direct comparison.

Second, like the ACS study, the Veterans Study was not originally designed to study air pollution. Rather, it was designed as a means of assessing the efficacy of anti-hypertensive drugs in reducing morbidity and mortality in a population with pre-existing high blood pressure. Due to this study design, as noted in the 4th External Review Draft of the PM Criteria Document, this may cause loss of follow-up resulting from cohort depletion that is unassociated with the exposure of concern. This effect can cause a significant loss of statistical power. This concern is reflected in the statement by the study authors, cited in the PM Criteria Document, that "...the relatively high fraction of mortality within this cohort may have depleted it of susceptible individuals in the later periods of follow-up." Rather than

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[2]Lipfert, F. W.; Perry, H. M., Jr.; Miller, J. P.; Baty, J. D.; Wyzga, R. E.; Carmody, S. E. (2000) The Washington University-EPRI veterans' cohort mortality study: preliminary results. In: Grant, L. D., ed. PM2000: particulate matter and health. Inhalation Toxicol. 12(suppl. 4): 41-73.

making this study more sensitive to the effects of PM-2.5, the study may have lost statistical power through loss of susceptible populations from conditions not associated with pollution.

Thus, a variety of issues associated with the study design, including sample representativeness and loss to follow up, make this cohort a poor choice for extrapolating to the general public. Furthermore, the selective nature of the population in the veteran's cohort and methodological weaknesses may have resulted in estimates of relative risk that are biased relative to a relative risk for the general population.

In RIA Chapter 9's economic benefits assessment, consistent with guidance from the SAB-HES, we have elected to use the Pope 2002 reanalysis of the ACS study as the basis for our primary mortality estimate. This reanalysis includes expanded coverage for risk factors including many of those cited by the commenter in recommending the Veteran's Study (e.g., age, smoking status, and body-mass index). Consideration of these risk factors in the Pope reanalysis has shown the association of $PM_{2.5}$ and mortality to be robust to consideration of these variables. Because the Pope 2002 reanalysis addresses the issue of risk factors, we believe that use of the Pope reanalysis for the FRM-NRD largely addresses this commenter's concern that risk factors were not being sufficiently addressed in assessing mortality. We also do not agree with the commenter's assertion that the Veteran's Study population is necessarily more sensitive to PM effects. Because the Veteran's study included individuals with elevated smoking rates, and hypertension, it is possible (as stated by the study authors), that the relatively high mortality of the study population may have depleted that population of susceptible individuals for $PM_{2.5}$-related health effects. This would make it more difficult to establish an association between $PM_{2.5}$ exposure and mortality. In addition, a compelling argument can be made against the use of the Veteran's Study for impact estimation on the grounds that it used a study population, which is not representative of the general population. The Veteran's Study population was 1) all male, 2) veterans, and 3) diagnosed hypertensive. There are also a number of other differences between the composition of the sample and the general population, including a higher percentage of African Americans (35 percent), and a much higher percentage of smokers (81 percent former smokers, 57 percent current smokers) than the general population (12 percent African American, 24 percent current smokers).

Although we did consider the study (and others that were not explicitly mentioned) because we are relying on the criteria documents, we have added discussion of the Veteran's Study to Chapter 2 of the RIA as well as the AHSMOG studies and the Dutch NCLS cohort (Hoek et al., 2003)

2.2.1.1.2 County Study

What Commenters Said:

The Mercatus Center commented that EPA should include the County Study in the RIA, which is an important analysis of the relationship between PM and mortality. The County Study (see F.W. Lipfert and S.C. Morris, "Temporal and Spatial Relations between Age Specific Mortality and Ambient Air Quality in the United States: Regression Results for Counties, 1960-97," Occupational and Environmental Medicine, vol. 59, no. 3 (2002), pp. 156-174) is a full ecological study, included all U.S. counties with air pollution monitoring data, and assessed the relationship between pollution levels and mortality at the county level between 1960 and 1997. This study also assessed the relationship between pollution and mortality for several time periods, and included both concurrent and delayed health effects of pollution exposure. This study has found an association between $PM_{2.5}$ and increased mortality but also found that there is a threshold between 20 and 25 ug/m3, below which $PM_{2.5}$ had no effect. This study showed little or no evidence for cumulative effects from longer term exposure. The Mercatus Center provided additional discussion on this study and recommended that based on the problems of uncontrolled confounding, short latencies, and biologically implausible associations in the ACS and Six Cities studies, combined with the negative results of the Veterans and County studies, EPA should set its annual $PM_{2.5}$ standard at no less than 20 ug/m3.

Letters:
Mercatus Center, OAR-2003-0012-0627, 0828 p. 19

Our Response:

We did consider the study (and others that were not explicitly mentioned) because we are relying on the criteria documents. The Lipfert and Morris (2002) County Study is not specifically discussed in the RIA. As discussed in the 4th External Review Draft of the PM Criteria Document, the ecological nature of the study makes the County study results difficult to interpret. The study included some covariates which may confound the relationship with air pollution. Two of the ecological variables, vehicle miles of travel per square mile per year by gasoline and diesel vehicles, respectively, in a county (also used in Janssen et al., 2002) are likely to have important associations with air pollution, and had varying associations with mortality in the study. Furthermore, some models employed included the percentage of air conditioning in a county, a factor that may well be correlated with greater secondary aerosol formation in warmer temperatures and is likely associated with diminished exposure to air pollution, resulting in smaller acute health effects per μg/m3 of PM pollution (Janssen et al, 2002). Given these potentially confounding terms in this study's model, the Criteria Document does not rely on this study in its conclusions, and therefore, the RIA does not address it.

Consistent with Science Advisory Board's Health Effects Subcommittee (SAB-HES) advice, the Agency is using the Pope 2002 reanalysis of the ACS study as the basis for the primary estimate of mortality in the final RIA Chapter 9. The authors of the Pope reanalysis note that, for the range of exposures considered in their reanalysis, the slope of the concentration-response function appears to be monotonic and nearly linear, although they cannot exclude the potential for a leveling off or steepening at higher exposure levels.

The EPA Science Advisory Board's Advisory Council for Clean Air Compliance, which provides advice and review of EPA's methods for assessing the benefits and costs of the Clean Air Act under Section 812 of the Act, has advised that there is currently no scientific basis for assuming any specific threshold for the PM-related health effects considered in typical benefits analyses (EPA-SAB-Council-ADV-99-012, 1999). Also, the National Research Council (NRC), in its own review of EPA's approach to benefits analyses, has agreed with this advice.

This advice is supported by the recent literature on health effects of PM exposure (Daniels et al., 2000; Pope, 2000; Pope et al., 2002, Rossi et al., 1999; Schwartz, 2000) which generally finds no evidence of a non-linear concentration-response relationship and, in particular, no evidence of a distinct threshold for health effects. A recent draft of the EPA Air Quality Criteria for Particulate Matter (U.S. EPA, 2002) reports only one study, analyzing data from Phoenix, AZ, that reported even limited evidence suggestive of a possible threshold for $PM_{2.5}$ (Smith et al., 2000).

Thus, it is appropriate and reasonable to include the estimated benefits associated with all reductions in $PM_{2.5}$ using non-threshold models, to provide a comprehensive picture of the estimated public health impacts associated with projected future controls on PM precursor emissions.

Consequently, for the primary analysis, the Agency is not assuming a threshold. However, the Agency agrees with the NAS and SAB-HES that the issue of a potential threshold in relation to $PM_{2.5}$-related mortality remains an area of uncertainty. The Agency is currently developing a framework for characterizing uncertainty in the benefits modeling process, which will include consideration for the shape of the mortality concentration response function. As that work is completed, we will consider integrating a more complete treatment of uncertainty in these functions into our modeling of $PM_{2.5}$-related mortality incidence.

2.2.1.1.3 Other Studies

What Commenters Said:

NRDC cited to and attached as supporting documentation: Solomon, Gina, M.D., "Health Effects of Diesel Exhaust," Clinics in Occupational and Environmental Medicine, 2003; and cited to the ALA/Environmental Defense report entitled "Closing the Divide," April 2003, and provides a web site reference for this report. The Clean Air Coalition also cited the USC Keck School of Medicine study, which found that the health of children growing up in southern California was directly impaired by NO_x and PM emissions and that their lung function was reduced by 10 percent. Environmental Defense cited a four year study summarized in a 2002 article from the American Journal of Respiratory and Critical Care Medicine, which shows that children in L.A. suffer significant deficits in lung-growth function due to exposure to NO_x, PM, and elemental carbon.

Letters:
New York Public Hearing, A-2001-28, IV-D-05 [CATF p. 234; NRDC p. 28]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [NRDC p. 53]

Our Response:

We agree that emissions from Nonroad Diesel engines contribute to serious health effects and that children are especially vulnerable. Through the development of criteria documents for ozone, SO_2 and PM and the *Health Assessment Document for Diesel Engine Exhaust* (Diesel HAD), we have carefully reviewed the science in public forums with expert and public review. We are relying on those documents in our interpretations of the science. The RIA is not meant as a “weight of evidence” of current air pollution science, but rather a highlight of the key scientific issues as defined in EPA’s criteria documents.

2.2.1.2 Use of the ACS and Six Cities Studies

2.2.1.2.1 Pollutants Included in Studies

What Commenters Said:

The Mercatus Center commented that the ACS and Six Cities studies do not accurately portray the association between $PM_{2.5}$ and mortality. The ACS study assessed health effect using a statistical model that included $PM_{2.5}$ as the only pollutant. But the HEI reanalysis include SO_2 levels in the model as a potential confounder and found that only SO_2, not $PM_{2.5}$, was associated with mortality. This suggests that confounding factors by other pollutants compromised the accuracy of the ACS study.

Letters:
Mercatus Center, OAR-2003-0012-0627, 0828 p. 14

Our Response:

The final rule reduces SO_2, as well as $PM_{2.5}$, NOx, ozone, and air toxics. In 2010, our final program will reduce SO_2 emissions by 260,000 tons, which will grow to 375,000 tons reduced in 2030.

We agree with the need to address copollutants when employing epidemiologic models. The HEI reanalyses generally confirmed the original investigators' findings of associations between mortality and long-term exposure to PM, while recognizing that increased mortality may be attributable to more than one ambient air pollution component. Regarding the validity of the published Harvard Six-Cities and ACS Studies, the HEI Reanalysis Report concluded that overall, the reanalyses assured the quality of the original data, replicated the original results, and tested those results against alternative risk models and analytic approaches without substantively altering the original findings of an association between indicators of particulate matter air pollution and mortality.

The most recent external review draft of the PM criteria document reaches similar conclusions.

While the Agency recognizes the ongoing need to research the issue of copollutants, including SO_2, and their role in quantifying the relationship between long-term exposure to $PM_{2.5}$ and mortality, we disagree with the commentor's interpretation of the HEI reanalysis and their assertion that SO_2 is associated with mortality and not $PM_{2.5}$. Although the HEI reanalysis did find a robust association between mortality and SO_2, such an association was also reported for fine particles and sulfate. In addition, the study points out that efforts to address spatial autocorrelation for ecologic-scale variables such as fine particles and sulfate may have over-adjusted estimated effects for these regional pollutants compared with effect estimates generated for local copollutants including SO_2. This could partially account for the higher effect estimate generated for SO_2 relative to fine particles and for sulfate. In addition, SO_2 is associated with sulfate formation and consequently, SO_2 concentrations are likely surrogates for sulfate concentrations, which could explain their statistical association with $PM_{2.5}$-related mortality.

In considering this issue of SO_2 as a copollutant and its impact on the association between mortality and long-term exposure to $PM_{2.5}$, it is also important to consider the wider literature. Two recent studies examining the relationship between gaseous copollutants (including SO_2) and PM-related health effects including mortality (Samet et al., 2000, 2001), conclude that SO_2 is likely to represent a surrogate for ambient $PM_{2.5}$ concentrations and may in certain circumstances represent a surrogate for personal exposure to $PM_{2.5}$. Furthermore, both studies conclude that SO_2 is unlikely to be a confounder for $PM_{2.5}$-related health effects (i.e., it is unlikely to be associated directly with these health effects while being correlated with $PM_{2.5}$ exposure). Further evidence against SO_2 as a confounder specifically for mortality effects involves biological plausibility. While SO_2 is recognized as effecting airways causing difficulty in breathing, especially for asthmatics, there is little evidence of a causal link between SO_2 exposure and cardiovascular- or lung cancer-related mortality. This argues against SO_2 as a confounder for $PM_{2.5}$-related mortality effects.

Following recommendations from the NAS and SAB-HES, we have continued to update our methods for benefits estimation to reflect the latest research and are now using the Pope, 2002 reanalysis of the ACS study data. This latest reanalysis has a number of advantages over prior studies in evaluating the role of SO_2 in the relationship between $PM_{2.5}$ exposure and mortality. The Pope 2002 reanalysis includes 8 additional years of follow up data, including data on fine particulates and gaseous copollutant exposure. The Pope 2002 reanalysis also considers a variety of additional covariates believed to be associated with mortality and uses the latest statistical methods (e.g., non-parametric spatial smoothing) for addressing key issues such as spatial autocorrelation. While the Pope 2002 reanalysis continues to show a strong correlation between SO_2 and all cause and cardio-vascular mortality, suggesting that it is likely a surrogate for particulate fine and more likely sulfate exposure, the study also provides the strongest evidence yet for an association between long-term exposure to $PM_{2.5}$ and mortality.

2.2.1.2.2 Socioeconomic Factors

What Commenters Said:

The Mercatus Center commented that the ACS and Six Cities study results suggest that the association of $PM_{2.5}$ with mortality might instead be a dubious association caused by confounding socio-economic factors. For the ACS study, there was no association between $PM_{2.5}$ and mortality for people with more than a high school education, women, elderly (from age 60 to 69), current or never-smokers, or those that were sedentary or very active. In addition, when population change was added into the model as a potential confounder the $PM_{2.5}$ effect declined by two thirds and became statistically insignificant. The ACS study included health-related data based on information from 1982, which could be inaccurate given the potential changes to overall diet, weight and other factors in the past two decades. The Six Cities study results also suffer from residual confounding with respect to level of exercise and education.

Letters:
Mercatus Center, OAR-2003-0012-0627, 0828 p. 14-16

Our Response:

We disagree that the ACS and Six Cities studies conclusions regarding $PM_{2.5}$ are attributable to strictly socioeconomic factors. In the studies, the estimated fine particle effect on cardiopulmonary mortality and cancer mortality remained relatively stable even after adjustment for smoking status, although the estimated effect was larger and more significant for never-smokers versus former or current smokers. The estimates were relatively robust against inclusion of many additional covariates: education, marital status, body mass index (BMI), alcohol consumption, occupational exposure, and dietary factors. However, as the authors note, the data on individual risk factors were collected only at the time of enrollment and have not been updated, so that changes in these factors since 1982 could introduce risk-factor exposure mis-classification and a consequent loss of precision in the estimates that might limit the ability to characterize time dependency of effects. Moreover, it is noteworthy that this study found education to be an effect modifier, with larger and more statistically significant PM effect estimates for persons with less education. This may be due to the fact that less-education is a marker for lower socio-economic status and, therefore, poorer health status and greater pollution susceptibility. These results may also be an indicator that the mobility of the less educated provides better estimates of effects in this study (with no follow up of address changes) than for the more mobile well-educated. In either case, because this cohort comprises a much higher percentage of well-educated persons than the general public, the education effect modification seen suggests that the overall PM effect estimates are likely underestimated by this study cohort versus that which would be found for the general public.

Following recommendations from the SAB-HES, we have updated our benefits characterization methodology to use the latest reanalysis of the ACS study data (Pope, 2002) as the basis for our primary morality estimate. This analysis incorporates several enhancements that strengthen conclusions regarding the association between long term exposure to $PM_{2.5}$ and mortality and increases our ability to examine the potential for effects modification by a range of possible risk factors including those mentioned by the commentor (e.g., educational status, age, smoking status). These enhancements include: (a) addition of 8 years of follow-up data with an increase in number of deaths, (b) inclusion of range of dietary covariates in modeling, (c) improvements in treatment of occupational exposure and (d) refinements in methods used to address potential spatial autocorrelation in ecologic variables. The results of the Pope 2002 reanalysis, rather than suggesting that socioeconomic factors are confounders, point to several of these variables as potential effects modifiers. Furthermore, the results of the reanalysis show that, with the exception of smoking status, the mortality association with $PM_{2.5}$ is not highly sensitive to inclusion of risk factors considered in the analysis, including education and age. The reanalysis suggests that many of these risk factors may represent effects modifiers for the $PM_{2.5}$ mortality association (and not confounders). In the case of educational status, this variable may be linked to socioeconomic status which can, in turn, be linked to factors which could impact an individual's risk for mortality and morbidity effects from $PM_{2.5}$ exposure, such as access to health care. It is likely that, should our benefits analysis methodology be further refined to model $PM_{2.5}$-related mortality for populations differentiated on education and other potential effects modifiers, overall incidence estimates for mortality and morbidity would increase.

2.2.1.2.3 Latency Periods

What Commenters Said:

The Mercatus Center commented that the development of cardiovascular disease or cancer has a latency period of 15 to 20 years. However, the measurements for the ACS and Six Cities studies occurred around the same time the study began in the early 1980s, and for the ACS study, the range of PM levels was about four times higher during the 1960s than during the 1980s. The Mercatus Center further noted that this suggests that the health effects of a given increase in PM would be significantly lower than these studies estimate.

<u>Letters:</u>
Mercatus Center, OAR-2003-0012-0627, 0828 p. 15-16

Our Response:

We disagree with the comment. No data on $PM_{2.5}$ is available for periods prior to the U.S. EPA

Inhalable Particle Network used in the ACS study. The commenter cites information regarding total suspended particulates (TSP) prior to the study period, but this information is not directly applicable to the $PM_{2.5}$ data used in the ACS study.

The SAB-HES noted in its review of the Agency's method for conducting $PM_{2.5}$-related economic benefits analysis, that the issue of latency/lag associated with specific health effects remains a source of uncertainty in assessing benefits and is an area requiring additional research. As the SAB-HES points out, a lack of detailed temporal exposure data for individuals included in long-term prospective cohort studies makes it difficult to characterize latency and lag periods (for purposes of defining cessation lags following regulatory implementation) for specific PM-related health effects. As additional information related to latency and lag periods becomes available, we will incorporate those data into our benefits analysis methodology.

While acknowledging limitations in our understanding of latency/lag periods associated with specific health endpoints, we do recognize the likelihood that lung cancer-related mortality may have a longer latency period. In fact, the Agency has cited this as a likely reason for the original ACS study not detecting a significant association between $PM_{2.5}$ exposure and lung cancer mortality. However, the latest reanalysis of the ACS study (Pope, 2002), which includes additional follow-up data on exposure, mortality and risk factor covariates for the study population, has detected a significant association between lung cancer and long-term exposure to $PM_{2.5}$. This further strengthens the argument for a longer latency period for long cancer. However, consideration of a longer latency period for lung cancer through inclusion of the follow-up data in the Pope 2002 analysis, has served to strengthen the relationship between $PM_{2.5}$ exposure and long cancer, rather than weakening it, as suggested by the commenter.

In the case of cardiovascular-related mortality, the inclusion of additional follow-up data in the ACS reanalysis resulted in a reduction in the effects estimate, although the association between long term $PM_{2.5}$ exposure and cardiovascular mortality remained significant. In contrast to lung cancer, this trend does not argue for a longer latency period and its specific implications for a cardiovascular mortality latency period is unclear. However, it is important to point out that, by including the follow-up data in the Pope 2002 reanalysis, this study tracks the study population over 20 years from the standpoint of both exposure and mortality, which weakens the argument that the ACS study focused on mortality associated primarily with higher PM exposure from earlier periods (i.e., the 1960's).

2.2.1.2.4 Carcinogenic Substances

What Commenters Said:

The Mt. Sinai Center for Occupation and Environmental Medicine commented that particulate matter in diesel exhaust contains a wide range of carcinogenic substances, including those substances that are present in cigarette smoke that are notorious for their carcinogenicity. The commenter further noted that these substances tend to adhere to the particulates in diesel exhaust and are carried deep into the recesses of the lung, along with fine carbon base parts; in addition, benzene is present in amounts comparable to the concentrations of the carcinogenic V agents.

<u>Letters:</u>
New York Public Hearing

A-2001-28, IV-D-05 [Mt. Sinai Center for Occupational & Environmental Medicine p. 242]

Our Response:

We agree that diesel exhaust is a likely human lung carcinogen, as described in the Diesel HAD. In addition, it is possible that the epidemiologically-derived effects estimates for $PM_{2.5}$ exposure capture some of the constituent-specific cancer mortality incidence resulting from diesel particles contained in diesel exhaust.

While recognizing the challenges associated with modeling benefits for individual HAPs, the Agency is continuing to develop methods for HAPs benefits assessment and will consider their application as they become available.

2.2.1.2.5 PM-Mortality Relationship Over Time

What Commenters Said:

The Mercatus Center commented that a comparison of the ACS results from 1982 to 1989 with those for 1990 to 1998 suggest that $PM_{2.5}$ risks are decreasing with time. The PM-mortality relationship for 1990-1998 is statistically insignificant.

Letters:
Mercatus Center, OAR-2003-0012-0627, 0828 p. 15

Our Response:

The commenters do not cite primary data, but rather an inference that is not possible to confirm or refute at this point. Regarding the issue of significance, the commenters base their estimate of the confidence intervals on the size of confidence intervals from other periods. This approach is not a valid method for estimation of confidence intervals.

It is important to differentiate between trends in $PM_{2.5}$ concentrations and the strengths of association between long-term $PM_{2.5}$ exposures and mortality. Associations between $PM_{2.5}$ exposure and mortality can remain strong, or even strengthen (in the case of lung cancer), even as the general trend in $PM_{2.5}$ ambient concentrations over the study period has decreased. In this context, mortality risk associated with a unit change in long-term $PM_{2.5}$ exposure can remain constant, or even increase due to better data, while overall population-level exposure and hence mortality linked to $PM_{2.5}$ exposure is decreasing. Specifically, with the Pope et al. 2002 reanalysis of the ACS data, inclusion of follow-up data, likely including individuals experiencing somewhat reduced overall $PM_{2.5}$ exposure (reflecting a general decrease in $PM_{2.5}$ ambient trends) has resulted in a strengthening in the effect estimate for lung cancer mortality, while producing a decrease in the effect estimate for cardiovascular mortality (although the association for cardiovascular mortality still remains significant).

Further, we did not base our conclusions on any single study, and the larger body of time series PM studies provide evidence for the association between PM and mortality, as discussed in the criteria document.

2.2.1.2.6 Harvard Six Cities Study

What Commenters Said:

The Mercatus Center commented that the Harvard Six Cities study only included 6 locations, thus precluding the possibility of investigating whether other pollutants in the statistical analysis affected the apparent mortality contribution of $PM_{2.5}$.

Letters:
Mercatus Center, OAR-2003-0012-0627, 0828 p. 16

Our Response:

As discussed above, through the development of criteria documents for ozone, SO_2 and PM and the *Health Assessment Document for Diesel Engine Exhaust* (Diesel HAD), we have carefully reviewed the science in public forums with expert and public review. We are relying on those documents in our interpretations of the science. The RIA is not meant as a "weight of evidence" of current air pollution science, but rather a highlight of the key scientific issues as defined in EPA's criteria documents.

Specifically regarding the commentor's criticism of the Harvard Six Cities study, we recognize certain limitations of the original study, including the use of a study population selected from a relatively small number of urban areas, which may decrease coverage for diverse conditions regarding exposure. However, the reanalysis of the Six Cities study conducted by the HEI, does examine specific issues related to $PM_{2.5}$ mortality that are not addressed as completely by other studies, including the issue of time-dependent covariates which are supported by follow-up questionnaires administered to the study population as part of the HEI reanalysis. However, as noted in the PM criteria document and in the HEI reanalysis report, the Six Cities and ACS studies each have relative strengths and weaknesses, making different analyses possible with each data set.

Consistent with advice from the SAB-HES, we have selected the Pope et al. 2002 reanalysis of the ACS study as the basis for the primary mortality estimate in the final economic benefits analysis in RIA Chapter 9. One strength of the Pope et al. 2002 reanalysis is that it integrates follow-up data regarding possible copollutants including sulfate, sulfur dioxide, nitrogen dioxide, carbon monoxide, and ozone. Results of the Pope et al. 2002 reanalysis suggest that, of the copollutants considered, only sulfur dioxide has a significant association with mortality. The Agency has concluded, based on a variety of evidence (see Response to Comment #1 above) that SO_2 is unlikely to represent a confounder and is more likely a surrogate for sulfate, which would account for its association with mortality in the Pope et al. 2002 reanalysis.

2.2.2 Short-term Exposure Effects related to PM and Diesel Exhaust

2.2.2.1 EPA Should Consider Specific Studies or Endpoints

What Commenters Said:

One commenter (Dr. Pandya) cited to his article as published in 2002 in Environmental Health Perspectives, which examines the impact of diesel exhaust on asthma.

Letters:
Los Angeles Public Hearing, A-2001-28, IV-D-06 [1 private citizen p. 229]

The American Lung Association and another commenter (Miller) stated that heart attacks can be triggered by acute inflammatory episodes that are sometimes due to exposure to air pollution. The private citizen cited to a paper entitled "Increased Particulate Air Pollution and Triggering of Myocardia Infarction" published by the American Heart Association in 2002. This paper illustrates that there is a 1.7 increase in risk in the 24-hour period following a 20 microgram spike in $PM_{2.5}$. The commenters also noted that for each increase of 10 micrograms, there is a 6 percent increase of cardio-pulmonary mortality and added that there are numerous other articles that have been published that show a similar correlation.

Letters:
New York Public Hearing, A-2001-28, IV-D-05 [ALA p. 109]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [1 private citizen p. 244]

Our Response:

The final rule will reduce harmful emissions and protect sensitive groups such as outdoor workers, children, asthmatics and those with existing heart and lung disease. We agree in general with comments supporting the rule due to adverse health effects from exposure to pollutants such as particulate matter associated with nonroad diesel engines.

We agree in general with the comment and are doing additional evaluation of the health effects of particulate matter for adverse cardiac events and cardio-pulmonary problems in the EPA Criteria Document for Particulate Matter.

2.2.2.2 Analysis of Short-term PM Exposure Health Effects

What Commenters Said:

The Mercatus Center commented that EPA's analysis of short-term PM health effects is inaccurate, since it fails to address research that is counter to EPA's conclusions. They further stated that our analysis on short-term PM exposure should address: 1) whether confounding by other pollutants or from other health-related factors, such as temperature and humidity, have been adequately controlled; 2) whether PM in general or a specific component is responsible for health effects (recent evidence suggests that trace metals might be a factor); 3) the degree to which researchers' judgment and taste affect the outcome of a modeling study; 4) whether there is a threshold below which PM has no health effects; and 5) whether PM reduces life expectancy by only days in already-frail people or by months or years in healthy people. The Mercatus Center provided additional discussion on these issues, citing to other studies that could provide additional information, and concluded that EPA has selectively cited and highlighted only those studies that support its view of the health effects of daily changes in $PM_{2.5}$ levels.

Letters:
Mercatus Center, OAR-2003-0012-0627, 0828 p. 19-22

Our Response:

We are relying on the conclusions in the criteria document regarding health effects studies. For example, Conclusion #2 in the epidemiology chapter of the Fourth External Review draft of the PM criteria document states, "A growing body of epidemiology studies confirm associations between short- and long-term ambient $PM_{2.5}$ exposures (inferred from stationary air monitor measures) and adverse health effects and suggest that $PM_{2.5}$ (or one or more $PM_{2.5}$ components) is a probable contributing cause of observed PM-associated health effects." p. 8-276

The questions of confounding are discussed in detail in Chapter 8 of the Fourth External Review Draft of the PM criteria document (e.g., see section 8.1.3 (page 8-8) and Section 8.4.8.3 (p. 8-263)). The PM criteria document's conclusion #10 states, "One major methodological issue affecting epidemiology studies of both short-term and long-term PM exposure effects is that ambient PM of varying size ranges is typically found in association with other air pollutants, including gaseous criteria pollutants (e.g., O_3, NO2, SO_2, CO0, air toxics, and/or bioaerosols.... Much progress in sorting out relative contributions of ambient PM components versus other co-pollutants is nevertheless being made, and overall, tends to substantiate that observed PM effects are at least partly due to ambient PM acting alone or in the presence of other covarying gaseous pollutants."

Moreover, Conclusion #5 in the epidemiology chapter of the Fourth External Review draft of the PM criteria document states, "Long-term PM exposure durations on the order of months to years, as well as on the order of a few days, are statistically associated with serious human health effects (indexed by mortality, hospital admissions/medical visits, etc.)." p. 8-277

We also agree with the commenter that more research is needed.

In addition, the economic benefits analysis framework used in Chapter 9 of the RIA for this analysis has been subjected to rigorous peer review by the SAB-HES. This review addressed specifically the selection of epidemiological studies for use in developing effects estimates for key health endpoints. This analytical framework also reflects recommendations provided by the NAS regarding the selection of epidemiological studies for mortality and morbidity endpoints. Consequently, the EPA believes that this economic benefits analysis reflects the best available scientific data and understanding regarding PM and ozone health effects incidence estimation and valuation. Scientists continue to work on improving our understanding of the health impacts of ozone and PM. As new studies are published, the EPA updates its benefits methodology accordingly (often including peer-review or the new data and methods). For the current analysis, EPA has updated its incidence estimation methods to reflect the latest chronic mortality study (the Pope 2002 reanalysis of the ACS study data). This study includes additional coverage for a range of individual risk factors not previously considered (e.g., smoking, educational status and age).

2.2.3 Health Effects Related to Ozone Exposures

2.2.3.1 The Relation of Ozone Exposure to Asthma Onset

What Commenters Said:

The Mercatus Center commented that the assertion in the RIA that ozone could be causing increased incidence of asthma is based on information that is no longer relevant. EPA cited two studies that reported an association between ozone and the development of asthma. The CHS: 1) was based on a relatively small number of individuals; 2) is irrelevant to current ozone levels, since there are currently no areas that have ozone levels that are as high as the levels that used to occur in southern California; 3) actually showed no correlation between asthma and activity level for medium or low ozone areas; and 4) showed that asthma incidence was actually 30 percent lower in the high-ozone communities when compared with the low-ozone communities. The AHSMOG study results also do not apply to current ozone levels. Mercatus provided additional discussion on this issue and provided data showing the differences in ozone between when the study was completed and more current levels.

Letters:
Mercatus Center, OAR-2003-0012-0627, 0828 p. 22-24

Our Response:

Studies regarding the association of ozone exposure and the development of asthma (not simply triggering symptoms in people with existing cases of asthma) are emerging in the peer-reviewed literature. We received numerous public comments describing asthma being on the rise and a problem in many areas across the country (see #2.1). Although the science is not definitive regarding the onset of new asthma and ozone exposures, we think these studies are suggestive of an effect and should be evaluated further. Additional research is also needed. We agree with the commenter that there was a relatively small number of new asthma cases in the CHS study, limiting the power of the study to detect effects of asthma cases at the lower ozone concentrations. The same is true of the AHSMOG study's limited statistical power, but effects were detected for higher ozone levels.

If a study of limited statistical power is able to detect an effect of higher ozone levels in a small study, one cannot rule out effects at lower levels simply because the study doesn't have the power to detect them. It is certainly possible that lower ozone concentrations have effects. This is supported by a nonhuman primate study in which ozone exposure was shown to enhance the sensitization of monkeys to platinum salts which is known to be a cause of new asthma. There is also a McConnell et al. study that has reported associations between ozone exposure and new onset asthma.

It has also been demonstrated in human controlled-exposure studies that ozone causes inflammation of the respiratory tissue when subjects are exposed to levels as low as 0.08 ppm ozone for prolonged periods of intermittent, moderate exercise. Inflammation of lung tissue is known to increase the risk of asthma attacks and worsen the severity of attacks. A recent study, Gent et al. (JAMA, Vol. 290, No. 14, October 8, 2003), reported an association between ambient fine particles and ozone concentrations below the level of the ozone NAAQS (mean levels were 0.059 ppm 1 hr avg. and 0.051 ppm 8 hr avg.) and an increased risk of respiratory symptoms in children under the age of 12 with physician-diagnosed active asthma residing in southern New England. The conclusion of Gent et al. (2003) was that asthmatic children using maintenance medication are particularly vulnerable to ozone, controlling for exposure to fine particles, at levels below EPA standards.

In addition, in our economics analysis, based on recommendations from the SAB-HES, we have not included the onset of new asthma cases resulting from ozone exposure in its primary benefits estimate. Instead, we have modeled asthma exacerbations (i.e., the increase in incidence of asthma attacks among individuals already diagnosed with asthma) for the primary analysis.

2.2.3.2 Ozone Reductions and UV Light

What Commenters Said:

The Mercatus Center commented that efforts to achieve EPA's 8-hour ozone standard will reduce beneficial effect of reducing UV light. Mercatus provided additional discussion on this issue, noting that achieving the 8-hour standards will be too costly and would reduce the beneficial effect of reducing exposure to the sun's UV light (since ozone levels provide some protection in this regard), implying that achievement of this standard should not be used as a justification for the proposed rule.

Letters:
Mercatus Center, OAR-2003-0012-0627, 0828 p. 29-32

Our Response:

EPA has already addressed this issue in the final response to the remand of the ozone NAAQS (68 FR 614, January 6, 2003). The final response to the remand, to consider the beneficial shielding effects of tropospheric ozone, makes clear that EPA has determined that any potential UV-B radiation-related effects associated with the O_3 standard set in 1997 are likely very small from a public health perspective. Further, the final notice also makes clear that the EPA has judged that the evidence of any such effects should be weighed no more heavily in a determination of O_3's net effects than the record evidence on O_3's potential chronic adverse effects. Thus, EPA has concluded that the information on O_3's net adverse effects is such that it does not warrant any relaxation of the standard set in EPA's 1997 final rule.

We further note that Nonroad Diesel controls are very cost-effective and that the net benefits exceed the costs by approximately three quarters of a trillion dollars over a 30 year period.

2.2.4 Approach for Evaluating Air Quality and Exposure

2.2.4.1 Choice of Monitor in a County and Monitor Placement

What Commenters Said:

The Mercatus Center commented that EPA should modify its approach for evaluating air quality and exposure; Mercatus believes that we overestimated the number of people exposed to air pollution levels that are in excess of current standards. EPA's data are misleading since only a portion of many nonattainment counties actually exceed the standards. Mercatus provided additional discussion on this issue and included data on the range of annual-average $PM_{2.5}$ readings for counties with two or more monitoring locations from 1999 to 2001 and the percent of ozone monitoring locations complying with the 8-hour and 1-hour ozone standards in selected counties. The commenter noted that many monitoring locations in nonattainment areas actually meet the standards, and concluded that we exaggerated the benefits of air quality improvements by overestimating the number of people at risk.

Letters:
Mercatus Center, OAR-2003-0012-0627, 0828 p. 24-29

API and Marathon commented that the proposed rule and supporting documentation point to the potential "risk" that several metropolitan areas may fail to achieve or maintain the NAAQS if the rule is not adopted; however, the population statistics are misleading since the non-attainment status is based on one monitor placed in a metropolitan area, which are often downwind of the urban core and register readings that are significantly higher than other monitors. The commenters stated that EPA should not cite population statistics but instead should develop measures and conduct exposure modeling that would more accurately characterize the potential risk to public health.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 41
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 37

Our Response:

EPA recently designated areas for attainment and non-attainment for the 8-hour ozone NAAQS. EPA has not yet designated new areas as non-attainment under the $PM_{2.5}$. In Chapter 2 of the RIA, we present an analysis of measured air quality data (that has been quality assured, certified, and that is complete). As described in detail in the technical support document, we list counties with a monitored design value (based on 3 years of complete data) that violates the standard. We then report the associated population as a way to represent potential exposures. We also report populations associated with nonattainment areas. We agree that not every person in the county would experience exactly the concentration at the central monitor. It is possible, based on activity patterns that the exposures to PM could be higher or lower. For example, we received public comment (NESCAUM) that exposures near Nonroad Diesel equipment and residences near construction sites where this equipment is operated, can be significantly higher than central site monitors. Furthermore, in Chapter 2 we summarize NATA modeling that takes into account people's activity patterns and presents exposure to diesel PM and other toxics from all sources, including nonroad diesel equipment.

2.2.4.2 Use of Metropolitan Statistical Area

What Commenters Said:

The New York Department of Environmental Protection commented that EPA should use metropolitan statistical areas (MSA) and CMSA as the basis for assessing attainment and non-attainment. The proposal utilizes the area wide extent of the county as the basic unit for assessing attainment and non-attainment, which is inconsistent with the practices of designation or classification of areas. In assessing attainment, the air quality analysis and model performance statistics should be limited to the examination of meeting the current 8-hour ozone NAAQS.

Letters:

New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 10

Our Response:

EPA recently designated areas for attainment and non-attainment for the 8-hour ozone NAAQS. EPA has not yet designated new areas as non-attainment under the $PM_{2.5}$ and 8-hour ozone NAAQS. We agree that EPA's past practices of designation or classification for areas for regional-scale pollutants does generally use larger geographic areas. However, at the time of the proposal, it was premature to anticipate how nonattainment boundaries might be configured. In Chapter 2 of the RIA, we present an analysis of county-level measured air quality data for $PM_{2.5}$. For the designated areas, we use the nonattainment boundaries and present associated population as a way to represent potential exposures.

We disagree that our analysis should be limited to the 8-hour ozone NAAQS because there continue to be areas that are designated as 1-hour nonattainment and maintenance areas. For our air quality modeling of future years, however, we presented analysis of 8-hour ozone violations, not 1-hour violations.

2.2.4.3 Accelerated Reductions to Aid Areas in Attaining the NAAQS

What Commenters Said:

As described in Section 3.1.1.4 below, we received comments that EPA should accelerate implementation of the standard to help facilitate compliance with the NAAQS.

The New York Department of Environmental Conservation commented that, with respect to projections, the analysis should focus on emissions benefits in 2015 since there are expected to be significant reduction in NO_x emissions by this time from nonroad engines. New York also believes that we should also address the potential effect of uncertainties on projected air quality, particularly in those instances where the projection years are beyond a decade since many jurisdictions have to come into compliance with the 8-hour ozone NAAQS at least a decade before these projection years.

<u>Letters:</u>
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 10

API and Marathon commented that the timing of air quality "need" is not matched to the generation of emissions benefits from the proposal. The assessment of need focuses on the ability of certain urban areas to attain or maintain the ozone and PM NAAQS in the 2007 to 2014 time frame, but EPA's inventory projection shows that the emissions benefits from the proposal are relatively small during this period of time and do not significantly accrue until after the year 2020.

<u>Letters:</u>
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 42
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 38

SCAQMD recommended that EPA should phase-in the proposed standards prior to 2010. This commenter noted that based on the SCAQMD 2003 Air Quality Management Plan, significant reductions of about 330 tons per day of VOC and 220 tons per day of NO_x are necessary by 2010 in order to ensure attainment with the federal ozone standards, and that under the current proposal, the NO_x and HC standard would only affect new nonroad diesel engines starting in 2011, and as a result, no reductions from these sources will be achieved by 2010. This commenter also recommended that EPA accelerate the phase-in of these new standard to be consistent with the attainment dates for the federal 1-hour ozone and PM 10 standards or should consider other interim standards for new engines prior to the attainment dates. Another commenter (Houston) noted generally that the proposal's delay until 2013 of controls for the largest equipment impairs their ability to reduce ambient ozone and PM from their own operations. The Texas Commission on Environmental Quality added that Texas expects to face 2007 attainment deadlines for the Early Action Compact (EAC) areas and 2010 and 2013 deadlines for other nonattainment areas under the 8-hour standard. This commenter concluded that the nonroad standard schedule will not help the 8-hour nonattainment areas in Texas reach attainment.

Letters:
City of Houston - Office of the Mayor, OAR-2003-0012-0630 p. 2
South Coast Air Quality Management District, OAR-2003-0012-0623 p. 1-2, 5
Texas Commission on Environmental Quality, OAR-2003-0012-0716, 0717 p. 2
Los Angeles Public Hearing, A-2001-28, IV-D-07 [SCAQMD p. 117]

Our Response:

In response to the comments from the New York Department of Environmental Quality, we agree that there will be significant emissions benefits from the program in 2015, and we have presented them in Chapter 3 of the RIA. However, because the engine requirements apply to new engines, our modeling must necessarily take into account the amount of time that it may take for the fleet to turn over and the new engines to be in operation. Thus, we present a stream of emissions benefits as well as costs and economic benefits. Given our limited resources to conduct sophisticated air quality modeling, we were forced to select years to represent our program. We selected 1996, 2020 and 2030 and conducted modeling. These years are consistent with our past modeling for the on-highway heavy duty diesel 2007 program. We agree that there are uncertainties with projecting into the future, and that many areas will be adopting state and local measures that may allow them to attain the ozone and PM NAAQS. However, given that the EPA implementation plans for the $PM_{2.5}$ and 8-hour ozone NAAQS are still developing, and consistent with our past practices, we modeled air quality for programs currently in place.

Because our regulations apply to new engines, it takes time for the compliant engines to enter the fleet and emissions benefits to accrue. The assessment of need focuses on the current need for reductions and our judgement that the need will likely continue into the future. We presented a variety of data to demonstrate this in Chapter 2 of the RIA. In Section 3.1.1.4 Implementation Timeline summarizes comments on the engine requirement timing. Some commenters provided general discussion on the health benefits of an accelerated schedule (e.g., Illinois Lieutenant Governor Pat Quinn, New York DEC, STAPPA/ALAPCO, CARB, SCAQMD) We also received public comment from manufacturers that they felt there is significant uncertainty regarding whether the technologies required by this rule can be developed and implemented within the proposed time frame, and an adequate period of stability is necessary between different tiers or sets of standards.

Although we agree that it would be desirable to achieve emission reductions sooner, manufacturers require adequate lead time to apply the pollution reduction strategies to meet our requirements. Further, as the 15 ppm sulfur fuel serves as a foundation for our systems approach, the widespread availability of the fuel is critical to the deployment of PM filters and other such technology.

We also agree that some areas will need to achieve reductions more quickly than our emissions modeling would suggest. EPA has a successful voluntary retrofit program that promotes emissions reductions from existing vehicles. Many areas are using innovative approaches to encourage early reductions. Some areas (e.g., Ohio) have considered using contractual requirements as an incentive for operators of nonroad equipment to use low sulfur fuel and to operate lower emitting equipment in roadway projects. We encourage states, local areas, tribes, businesses and trade groups to work with us to reduce emissions from this important sector.

2.2.4.4 EPA Should Clarify the Air Quality Benefits of the Rule

2.2.4.4.1 Nationwide Annual Modeling Approach

What Commenters Said:

API and Marathon commented that the inventories calculated by EPA are nationwide and annual, thus ignoring that ozone is a summertime urban problem. Consequently, the absolute emissions inventory benefits may be overstated by at least a factor of three if one adjusts from an annual basis to a summer ozone basis. EPA's projections of the urban impact of its proposal should be reduced even further since approximately 41 percent of the total 1996 nonroad land-based equipment population is located on farms which are presumably and predominantly in rural areas.

API specifically cited to Hanna, S.R., J.C. Chang, M.E. Fernau, "Monte Carlo Estimates of Uncertainties in Predictions by a Photochemical Grid Model (UAM-IV) due to Uncertainties in Input Variables," Atmospheric Environment 32 (21) (1998), p. 3619-3628, as supporting documentation for the assertion that there are inherent uncertainties and inaccuracies in ozone modeling.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 42-43
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 39

The New York Department of Environmental Conservation commented that a national approach should not be used to evaluate emissions impact and corresponding emissions reductions. Ground level ozone formation can vary on a large scale between different geographic regions due to the topography of an area and its meteorological patterns. The emissions modeling should have been performed from a regional perspective which would better represent the emissions impact of nonroad diesel equipment from a particular region of the country. EPA should use a one-atmosphere model (instead of the two photochemical models CAMx and REMSAD), since some of the precursors are common for ozone, $PM_{2.5}$, and regional haze.

Letters:
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 11

Our Response:

The commenters reason from a faulty premise. For example, although the inventories presented in the tables in Chapter 3 are annual, those used in the air quality modeling are processed to be appropriate inputs for air quality modeling as described in the technical support document (US EPA 2003a[1]). The mass inventories were prepared at the county level for mobile sources (including nonroad mobile sources). These county-level inventories contain typical summer season day emissions for NOx, VOC, CO, SO_2, primary PM and ammonia. The summer day mass emission inventories for each scenario modeled were processed using the SMOKE (Houyoux et al. 2000) model to create the appropriate emissions inputs for the Comprehensive Air Quality Model with Extensions (CAMx) air quality model. These emission inventories also take into account the location of nonroad sources, such as farm equipment being in more rural locations and construction equipment being located in more populous areas. These inventories, as described in the technical support document for emissions inventories (US EPA 2003b) account for average statewide temperatures and RVP for four seasons, including summer.

The air quality modeling analyses were conducted using two separate domains, one covering the eastern US and the other covering the western US. For the eastern U.S. domain, the model was applied over two episodes that occurred during the summer (for all five modeling runs). Similarly, for the western U.S. domain, the model was applied over three episodes that occurred in the summer. The meteorology and how the episodes were selected are described in detail in the technical support document (US EPA 2003a). As a result, the commenter's notion that the results need to be adjusted is based on an incorrect premise. We don't believe any adjustments are appropriate.

1. US EPA 2003a. Technical Support Document for the Nonroad Land-based Diesel Engines Standards Air Quality Modeling Analysis. US EPA, OAQPS, Research Triangle Park, NC. April 2003 (Docket number A-2001-28, Document number II-A-183).

2. Houyoux, M. Vukovich, J., Brandmeyer, J. 2000. Sparce Matrix Operator Kernal Emissions Modeling System (SMOKE) User Manual, Version 1.1.2 draft, MCNC- North Carolina Supercomputing Center Environmental Programs, 2000. Updates at Http://www.cmascenter.org/modelclear.html#smoke)

3. US EPA 2003b, Procedures for Developing Base Year and Future Year Mass Emission Inventories for the Nonroad Diesel Engine Rulemaking. Prepared by E.H. Pechan and Associates, 2003.

In conjunction with this rulemaking, we performed a series of ozone air quality modeling simulations for the Eastern and Western United States using Comprehensive Air Quality Model with Extension (CAMx). CAMx simulates the numerous physical and chemical processes involved in the formation, transport, and destruction of ozone. At present, there are no guidance criteria by which one can determine if a regional ozone modeling exercise is exhibiting adequate model performance. The base case simulations were determined to be acceptable based on comparisons to previously completed model rulemaking analyses (e.g., Ozone Transport Assessment Group (OTAG), the light-duty passenger vehicle Tier-2 standards, and on highway Heavy-Duty Diesel Engine 2007 standards). The modeling completed for this rule exhibits less bias and error than any past regional ozone modeling application done by EPA. Thus, the model is considered appropriate for use in projecting changes in future year ozone concentrations and the resultant health and economic benefits due to the anticipated emission reductions.

EPA acknowledges there are inherent uncertainties in air quality modeling and making projections to future years. Nevertheless, EPA believes air quality models are useful tools to assess relative changes in future air quality. In the North American Research Strategy for Tropospheric Ozone

(NARSTO) assessment of ozone modeling, the authors conclude, "Grid-based air-quality models provide a critical tool for tropospheric-ozone analysis and management. In addition to other merits, their ability to synthesize and assemble multiple, elements of the air pollutant system (or mathematical representations thereof), and thus allow them to be analyzed collectively, is a particularly attractive and useful feature." (See NARSTO Ozone Assessment, 2000).

In regards to the comment from New York, we note that we used a 12 kilometer grid resolution which is generally considered to be regional modeling. We use this regional scale modeling to evaluate on a national basis the air quality impacts of emissions and corresponding emissions reductions because we are regulating at the federal level equipment and fuel across the country. In conjunction with this rulemaking, we performed a series of ozone air quality modeling simulations for the Eastern and Western United States using Comprehensive Air Quality Model with Extension (CAMx). CAMx simulates the numerous physical and chemical processes involved in the formation, transport, and destruction of ozone. CAMx is a photochemical grid model that numerically simulates the effects of emissions, advection, diffusion, chemistry, and surface removal processes on pollutant concentrations within a three-dimensional grid. This model is commonly used for purposes of determining attainment/nonattainment as well as estimating the ozone reductions expected to occur from a reduction in emitted pollutants.

We agree that ground level ozone formation can vary on a large scale between different geographic regions due to the topography of an area and its meteorological patterns. Our regional CAMx modeling does account for regional differences in emissions and meteorology. We also agree that a one-atmosphere model would be beneficial. EPA has been developing a one-atmosphere model (CMAQ). However, as that model continues to be developed, we employed REMSAD and CAMx. We did not undertake new modeling for the final rule.

North American Research Strategy for Tropospheric Ozone. NARSTO: An Assessment of Tropospheric Ozone Pollution: A North American Perspective. NARSTO Publications, Pasco, WA. 2000. (http://www.cgenv.com/Narsto/)

2.2.4.4.2 Analysis of $PM_{2.5}$ Modeling and Ultrafine Modeling

What Commenters Said:

API and Marathon commented that EPA has projected substantial reductions in the populations exposed to violations of the $PM_{2.5}$ annual air quality standard in 2020 and in 2030 as a consequence of EPA's proposal. However, the modeling used to support these projections are subject to significant uncertainty. The model (REMSAD) underestimates $PM_{2.5}$ mass by 32 percent nationwide, 15 percent in the eastern U.S., and nearly 50 percent in the western U.S. It is difficult to reconcile this magnitude of underprediction with subsequent EPA statements that the model performance is encouraging. NARSTO's recent scientific assessment of chemical transport models used to model PM concludes that "very low" levels of confidence characterize the simulations of ultra fine PM performed by available chemical transport models (see NARSTO, Particulate Matter Science for Policy Makers - A NARSTO Assessment, February 2003, p. S-25).

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 41-42
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 37-38

The New York Department of Environmental Conservation commented that in the analysis of $PM_{2.5}$, the model performance is based on the IMPROVE data, which primarily represents Class I areas that are remote and/or rural. The nonroad land-based diesel engine (NLDE) emissions and controls are mostly oriented to urban areas. EPA should provide an estimate of the acceptable level of confidence for model performance with respect to urban areas that have no measured data during 1996. In addition, the nitrate data from IMPROVE is considered suspect, and IMPROVE recommends the use of a constant value. EPA should provide an explanation of why these data are then used in model performance assessment.

Letters:
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 11

Our Response:

We agree that there are uncertainties with making projections and with modeling complex air chemistry. EPA has projected substantial populations will potentially experience elevated concentrations of PM without our standards. In addition, our projections using a preliminary control scenario described in Chapters 2 and 3, indicate that there will be reductions in the populations potentially exposed to violations of the $PM_{2.5}$ annual air quality standard in 2020 and in 2030 as a consequence of the final rule. The commenters pointed out that the REMSAD model underestimates $PM_{2.5}$ mass by 32 percent nationwide, 15 percent in the eastern U.S., and nearly 50 percent in the western U.S., and that we are potentially underestimating the need and impact of our rule. EPA conducted a thorough model evaluation as part of our proposal (see Air Quality Modeling technical support document US EPA 2003a). We note that the performance for this analysis was an improvement over past regulatory modeling.

The commenters also quote the NARSTO report. The NARSTO report states, "The most advanced [chemical transport models] CTM for PM can currently predict the formation of sulfate and nitric acid satisfactorily (e.g., within 50%)." In the executive summary of the NARSTO report, the authors conclude,"Current chemical transport models are one useful tool for guiding policy as part of the collective scientific analysis, being most informative regarding the inorganic fraction (sulfate, nitrate, ammonium) on regional and episodic (days to weeks) scale." This is precisely the type of modeling we have undertaken for this rule, focusing on sulfate, nitrate and direct diesel PM emissions. Chapter 8 of the NARSTO report gives a fuller evaluation of the CMTs: "CMTs can predict concentrations of primary PM (e.g., [black carbon] BC, crustal material) satisfactorily provided the emissions are well characterized." The report mentions that there are larger uncertainties regarding particulate organic carbon and that CTMs typically perform better for long-term periods (e.g., 1 year) than shorter periods (e.g., 24 hours or less). (see NARSTO, Particulate Matter Science for Policy Makers - A NARSTO Assessment, February 2003, executive summary and Chapter 8 summary).

NARSTO's assessment of CTMs for ultra fine particles is accurate; however, it is not relevant as we did not attempt to model ultra fine particles separately from the fine particles (e.g., sulfates, nitrates, and black carbon) for which satisfactory models exist, such as REMSAD.

In response to New York's comments, we believe that we used the best available data to evaluate model performance. As discussed in Chapter 2 of the RIA and the air quality modeling technical support document (US EPA 2003a), speciated $PM_{2.5}$ data for 1996 are limited. IMPROVE provides a nationally consistent, chemically speciated data set to compare with our national modeling. Although the IMPROVE data do primarily represent Class I areas, they also include an urban area (Washington, DC). We agree that there are uncertainties with the nitrate data from IMPROVE. There are no other national data of similar quality and consistency for 1996.

1. US EPA 2003a. Technical Support Document for the Nonroad Land-based Diesel Engines Standards Air Quality Modeling Analysis. US EPA, OAQPS, Research Triangle Park, NC. April 2003 (Docket number A-2001-28, Document number II-A-183).

2.2.4.4.3 Clarification of Design Values and Modeling Assumptions

What Commenters Said:

The New York Department of Environmental Conservation commented that EPA should clarify the rationale behind using 1999-2001 design values to obtain future year design values and whether there were any model simulations performed with emissions from this design value period. The commenter believes that the entire modeling analysis should be revised to reflect current emissions and meteorological periods rather than to use those based on 1996. New York also commented that EPA should clarify what assumptions were made regarding electric generating units (EGU), and other large stationary sources in developing the emissions inventories for 2020 and 2030.

Letters:
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 10-11

Our Response:

As discussed in Chapter 2 of the RIA and the air quality modeling technical support document (US EPA 2003a), 1999-2001 data were the most current 3-year period of complete, quality assured and certified data for $PM_{2.5}$. In our modeling, EPA projected 1999-2001 design values to the 2020 and 2030 future year base and control scenarios. To provide future year estimates of $PM_{2.5}$ concentrations, relative reduction factors (RRF) were calculated and applied to the ambient data. The procedures for determining RRfs are similar to those in EPA's guidance for demonstrating attainment of air quality goals for $PM_{2.5}$ and regional haze (see US EPA 2003a page 46 Section F Projected Future $PM_{2.5}$ Design Values for more details). RRDs (for a given future year) represent the expected change between the 1996 emission and the future year. While somewhat inconsistent with the design value period, the impact of this inconsistency is expected to be small. It is not necessary to model meteorological episodes from this period, as we are assuming that meteorology similar to the 1995/1996 meteorology could occur again in the future.

1. US EPA 2003a. Technical Support Document for the Nonroad Land-based Diesel Engines Standards Air Quality Modeling Analysis. US EPA, OAQPS, Research Triangle Park, NC. April 2003 (Docket number A-2001-28, Document number II-A-183).

In our technical support document for emissions inventories, we specified the assumptions for

EGSs and other large stationary sources in developing emissions inventories for future year air quality modeling (see Chapter II). We used unit-level outputs from the Integrated Planning Model (IPM).

1. US EPA 2003b, Procedures for Developing Base Year and Future Year Mass Emission Inventories for the Nonroad Diesel Engine Rulemaking. Prepared by E.H. Pechan and Associates, 2003.

2.2.4.5 NO_x Reduction Strategy- The "Weekend Effect"

What Commenters Said:

The Mercatus Center commented that EPA should consider NO_x disbenefit and the "weekend effect". Mercatus believes that our NO_x reduction strategy is risky since it might not be effective at reducing ozone. The results of weekend effect research suggest that reducing ozone levels from their current relatively moderate levels down to the very stringent requirements of the 8-hour standard may be difficult for many areas. The commenter provided additional discussion on this issue, noting that the CARB study that EPA uses to support its position that NO_x reductions will not be detrimental to ozone formation and that other factors may be contributing to the weekend effect, was not yet published.

Letters:
Mercatus Center, OAR-2003-0012-0627, 0828 p. 32-35

EMA commented that the air quality model fails to take into account the weekend ozone effect that results from reduced NO_x-emitting activities. Further, EMA requested that EPA correct this prior to finalization of the Tier 4 rule. As supporting documentation, EMA referred EPA to Fujita, et al., "Evolution of the Magnitude and Spatial Extent of the Weekend Ozone Effect in California's South Coast Air Basin," Vol. 53, Journal of the Air and Waste Management Association, p. 802-816 (July 2003).

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 101

Our Response:

We agree with the commenters' observation that reducing ozone to the level of the 8-hour NAAQS may be difficult for many areas. Air quality modeling analyses conducted in support of the NonRoad Land-based Diesel Engine (NLDE) rule and other EPA rulemakings have indicated that the most efficient path to attainment of the NAAQS is a combination of national NOx reductions coupled with local VOC reductions in heavily urbanized areas. The modeling indicates that in 2020 that future year 8-hour ozone design values will be reduced by an population-weighted average of 1.6 ppb as a result of the emissions reductions in the NLDE rule.

The studies to which the commenter refers show that in some cities, decreased motor vehicle traffic (particularly diesels) results in a higher VOC/NOx ratio which, in airsheds that are VOC-limited, can result in higher ozone concentrations. As noted in the proposed rulemaking, we did consider both increases and decreases of pollutants. In fact, the air quality modeling predicts NOx disbenefits in the areas identified by some studies as "VOC-limited" (e.g., Los Angeles). This may be viewed as a additional validation of the models. However, these areas represent a small minority of the area in the

United States. While some empirical studies to date point to a weekend ozone effect related to NOx reduction, modeling conducted for this rule predicts that this rule will result in net gains in benefits as a result of reduced ozone and $PM_{2.5}$ related to NOx. In addition, there are substantial PM benefits associated with reducing NOx emissions.

We believe that our results indicate that it will be much easier for states to develop their State Implementation Plans (SIPs) which will attain and maintain compliance with the ozone NAAQS. In the limited number of cases mentioned above, we will work with states conducting more detailed local modeling of their specific local programs to ensure that they are designed to provide attainment. Notably, other upcoming federal measures to lower ozone precursors will aid these efforts. We are modeling only one program, not areas' overall strategies to achieve clean air. The comprehensive strategies embodied in the SIPs can balance various reduction strategies to meet the standards. If state modeling or local programs shows a need, the Agency will work with states to plan further actions to produce attainment with the NAAQS. For these reasons, we believe that the Nonroad Diesel program, when combined with a comprehensive program of regional reductions from relevant stationary, mobile, and area sources as well as local programs, will not result in increases in ozone that the commenter suggests.

We also note that no state responsible for achieving attainment of the ozone NAAQS has commented that the Nonroad Diesel standards will make achieving attainment harder. Many have commented to the contrary that it will aid them, that they would prefer to see the NOx reductions occur sooner, and that aftertreatment-based NOx controls should apply to diesel engines under 75 hp. For example, enthusiastic support for the final rule is given by the Northeast States for Coordinated Air Use Management (NESCAUM), by the State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officials (STAPPA/ALAPCO) and by individual states and districts (e.g., California Air Resources Board (CARB), South Coast Air Quality Management District (SCAQMD), Massachusetts, New York Department of Environmental Conservation (NY DEC) and Illinois).

Specifically, we received comments from CARB, the Ozone Transport Commission (OTC), Environment Northeast, and the Texas Commission on Environmental Quality, which stated that the proposed rule is important because of the necessity for federal action in this area. These commenters further noted that States are pre-empted from regulating standards from new engines and it is impractical for them to effectively regulate fuels and locomotives and marine engines at the state level. CARB specifically commented that almost 75 percent of the nonroad diesel engines in California are federally preempted and beyond CARB's authority to regulate. They noted that this program is an important part of states' overall strategies to achieve clean air.

Finally, we note that the CARB study is widely available and is posted on CARB's web page.

In regards to EMA's comments, the studies to which EMA refers, present evidence that in some cities, decreased motor vehicle traffic on weekends (particularly diesels) results in an increase in early morning ozone (due to less ozone titration from NO) and a higher ambient VOC/NOx ratio. In airsheds that are VOC-limited, these emission effects can result in higher ozone concentrations. As noted in the response to comment immediately above, the EPA air quality modeling conducted to support the rule does indicate that a small minority of areas, including the Los Angeles area discussed in Fujita (2003), will experience ozone increases as a result of the NOx emissions reductions. However, when viewed from a national perspective, the Nonroad Diesel rule will result in net gains in benefits as a result of reduced ozone and $PM_{2.5}$ related to NOx. EPA believes that air quality models can and should be used as primary tool to address the issue of the benefits of NOx control scenarios.

2.3 Nonroad Contribution and NONROAD Emission Model

2.3.1 Nonroad Contribution

2.3.1.1 Nonroad Sources Are a Significant Source of Diesel Emissions

What Commenters Said:

We received comments from many commenters which stated that nonroad sources will continue to be a significant source of diesel emissions.

The Sierra Club of Wisconsin commented that state and national data show that the reduction of emissions from the nonroad sector is crucial. EPA's National Air Toxics Assessment (NATA) released in 2002 shows that nonroad mobile sources contribute a greater percentage than all onroad sources of the cancer causing pollutants Benzene, 1,3-Butadiene, Diesel Particulates and Formaldehyde. In addition, Wisconsin data show that nonroad mobile sources accounted for 57 percent of the statewide emissions of these pollutants from all mobile sources. This amounts to a combined rate of about 28 million pounds per year of the most deadly cancer causing air pollutants being emitted solely in Wisconsin. Lastly, the commenter stated, diesel particulates comprise 44 percent of this total and are suspected as a cancer-causing agent and a cardiovascular, blood, and respiratory poison.

CARB and the Union of Concerned Scientists (UCS) commented that a significant portion of California's overall emissions are from nonroad sources. CARB noted that California has over 450,000 land-based engines in the diesel nonroad category, and a significant number of diesel powered boats and that these engines constitute 4 percent of total mobile source hydrocarbon emissions, 21 percent of NO_x and 58 percent of mobile source diesel PM. UCS noted that its recently published report includes data from EPA and CARB which shows that in every state and metropolitan area across the country, nonroad diesel engines are major sources of pollution. This report also shows that California and the L.A. metro area have the greatest amount of pollution from nonroad engines. UCS also noted that in L.A., nonroad emissions accounted for 118,000 tons of NO_x and nearly 7,000 tons of PM in 1999 and that California and Texas have the highest nonroad emissions in the nation.

NESCAUM commented that heavy duty engine emissions are significant contributors to elevated ozone levels, fine particulate matter, and are the principal emitters of several key toxic air pollutants of concern in the Northeast. As a result, NESCAUM stated, the concentration of metals such as iron and nickel are elevated in samples taken near areas where the use of nonroad equipment is prevalent; together, nonroad and highway heavy duty engines are responsible for roughly 33 percent of all nitrogen oxide emissions, 75 percent of motor vehicle-related particulate and 60 percent of aldehyde emissions in the Northeast. Lastly, NESCAUM noted that some estimates suggest that nonroad emissions alone will emit 60 percent of all mobile source particulates by 2010.

Environment Northeast commented that by 2020, nonroad land-based diesel engines will produce almost two-thirds of all land-based diesel emissions nationally and in Connecticut, nonroad engines currently account for more than half of total mobile source diesel particulate matter and 33 percent of all mobile nitrogen oxide emissions.

The New York Department of Environmental Conservation commented that nonroad diesel equipment is responsible for approximately 24 percent of particulate matter emissions and 13 percent of NO_x emissions from mobile sources in New York State; and if left uncontrolled, these contributions would be expected to double by 2030 without implementation of the proposed rule. Also, the majority of the particulate emissions are PM 2.5.

The Illinois EPA commented that approximately 17 percent of the NO_x emissions in Illinois are generated by nonroad equipment with agricultural and construction equipment comprising almost two-thirds of that total. The commenter further stated that nationally, it is estimated that nonroad engines emit nearly 50 percent of all PM emissions.

SCAQMD commented that in 2010, federal sources, including nonroad engines, aircraft, ships, and trains will contribute about 34 percent of NO_x emission in the South Coast Air Quality basin; and this amount for nonroad engines accounts for about 14 percent or 108 tons per day of NO_x in the basin.

U.S. PIRG commented that over the last two decades, PM emissions from nonroad engines has increased by 23 percent. The commenter further stated that under current standards, new nonroad diesel equipment greater than 50 hp can release 15 to 30 times more PM and 15 times more NO_x than a new truck or bus.

City of Houston - Office of the Mayor commented that diesel engines constitute less than 25 percent of the City of Houston's vehicle fleet, but account for 40 percent of the mobile source emissions and 35 percent of overall emissions. The commenter also noted that the nonroad portion of the fleet in Houston produces 26 percent of the mobile source emissions and 21 percent of the city's overall emissions.

The Massachusetts Department of Environmental Protection commented that nonroad emissions account for 22 percent of the 1999 Massachusetts statewide NO_x emissions inventory.

The Oregon Department of Environmental Quality commented that in Oregon, nonroad diesel engines consume about 25 percent of all diesel fuel used in the state but emit 65 percent of the PM, 47 percent of the NO_x, and 91 percent of the SO_x pollution from all diesel vehicles.

Letters:
City of Houston - Office of the Mayor, OAR-2003-0012-0630 p. 2
Massachusetts Department of Environmental Protection, OAR-2003-0012-0641 p. 1
Oregon Department of Environmental Quality, OAR-2003-0012-0779 p. 2
New York Public Hearing
A-2001-28, IV-D-05 [E NE 251; NESCAUM p. 91; NY DEC p. 1; U.S. PIRG p. 188]
Los Angeles Public Hearing
A-2001-28, IV-D-07 [IL EPA p. 229; Sierra Club- WI p. 122]
Chicago Public Hearing
A-2001-28, IV-D-06 [CARB p. 12; SCAQMD p. 118; UCS p. 66]

Our Response:

We agree that Nonroad Diesel emissions are significant sources of emissions and will continue to be so. We continue to estimates for the contributions from our national modeling to present a consistent methodology to evaluate impacts of the rule.

2.3.1.2 Nonroad Sources Contribute a Very Small Percentage to Overall Emissions

What Commenters Said:

The Diesel Technology Forum and the Oregon Wheat Growers League commented that emissions from nonroad engines contribute a very small percentage to overall emissions.

Diesel Technology Forum also commented that nonroad diesel engines account for less than 1 percent of all PM emissions from all sources, diesel emissions are trending downward and currently contribute only 7 and 1 percent of all NO_x and CO emissions, respectively. Between 1990 and 2000, PM emissions nationwide have declined by 2.3 percent and emissions from all diesel equipment have declined by 57 percent. For the nonroad sector, emissions have declined by 13 percent. These data show that progress is currently being made by the diesel industry in reducing emissions.

Letters:
New York Public Hearing, A-2001-28, IV-D-05 [Diesel Technology Forum p.159]

The Oregon Wheat Growers League commented that in Umatilla County, Oregon, there has been no statistically significant increase in nonroad diesel vehicles in the past 10 years, and in fact, the number of nonroad engines has decreased given the demise of the forest industry and the consolidation of wheat farms. Given these trends, Oregon concluded that nonroad engines are unfairly targeted and labeled as the cause of deteriorating air quality.

Letters:
Oregon Wheat, OAR-2003-0012-0593 p. 2

Our Response:

We disagree that diesel emissions from nonroad engines are a small source of diesel PM emissions. A number of state and local agencies commented to the contrary that the emissions from this category are significant. (See comment 2.3.1.) While it is true that land-based nonroad diesel emissions are presently decreasing due to existing regulations, EPA's emissions modeling shows that land-based nonroad NOx and $PM_{2.5}$ emissions will begin to increase again between 2015 and 2020 without the new standards set forth in this rule. Also, a major source of PM in some areas (especially rural areas) is earth crustal material and re-entrained road dust which tends to be larger than 2.5 microns. When only PM below 2.5 microns is considered, the contribution of nonroad diesels is significant.

Nonroad diesel emissions and equipment populations can vary widely from county to county. Nonroad diesel emissions might be unchanged or decreasing in Umatilla County, but they may very well be increasing in neighboring counties. One of the pollutants that this rule specifically targets, NOx, is a precursor to ozone and PM formation. Research has shown that ozone and $PM_{2.5}$ can travel long distances into neighboring counties, regions, and states. While a given county may not have significant nonroad diesel emissions within its borders, other counties may have significant amounts of these emissions which may have an adverse impact on the given county. Also, nonroad diesel equipment, such as construction equipment, may travel from county to county within a region depending on where they are needed. Lastly, while this rule specifically targets nonroad diesel engines, EPA has also addressed reducing emissions from on-highway and stationary sources as well.

2.3.1.3 EPA's Estimate of the Nonroad Contribution to Overall Emissions May Be Inaccurate

What Commenters Said:

The Colorado Department of Public Health and Environment commented that recent Colorado study data indicate that nonroad diesel source category emissions comprise roughly 30 percent of total diesel exhaust emissions. Study data were obtained from fuel purchase records, VMT data, nonroad and on-road fuel sulfur content analyses, and off-road diesel equipment surveys. Colorado's 30 percent estimate contrasts to EPA's estimate of 44 percent. Recent and current construction and development activity in Colorado as well as projected increases for on-road truck traffic may be similar to other states. Colorado believes that for improved estimates and more accurate tracking of the HAP and criteria pollutant emissions reductions, EPA should consider the results of the Colorado study.

Letters:
Colorado Department of Public Health and Environment, OAR-2003-0012-0687 p. 1

Our Response:

Colorado's study gives a more precise estimate of nonroad diesel emissions at the local level and provides a valuable tool that will help in the effort to reduce diesel emissions there. EPA based its estimates on an analysis of emissions at the national level. EPA does provide some emissions estimates for selected cities in the RIA, but these were allocated from the national emission totals. Although EPA has fine-tuned its emission estimates for the final rule, no new air quality modeling was conducted.

2.3.2 The NONROAD Emission Model

2.3.2.1 Peer Review

What Commenters Said:

EMA commented that there are numerous updates to EPA's NONROAD2002 model that have not been subject to a peer review, and that unlike EPA's MOBILE model, there is no formal review process for NONROAD. EMA noted that the "substantially revised" version was not made publicly available until the beginning of July 2003, more than a month after the publication of the NPRM. Which it believes has resulted in an emissions model that has received little, if any, technical or peer review. Also, EMA commented, the exclusive consideration given to States by posting the NONROAD 2002 model earlier at a secure web site for States, is inappropriate. EMA noted that all stakeholders, including the regulated industry, require a fair and equal opportunity to assess EPA's basis for justifying the Tier 4 rule and provide meaningful input.

API and Marathon commented that even though the model has been presented and discussed at several public workshops, it has never been subject to formal peer review by an independent panel. NONROAD2002 is still in draft form and there are significant data gaps, such as the lack of estimates for hot soak or running loss VOC emissions or nonroad mobile source air toxics. These commenters further stated that the rule cannot be finalized based on benefits that are subject to such uncertainty.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 45-46
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 93
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 42

Our Response:

Peer Review

EPA has adhered to its peer review policy regarding the NONROAD Model. While the NONROAD model has not undergone peer review by an independent panel, such as the National Academy of Sciences (NAS), there has been an ongoing process of peer review for the NONROAD model. Each type of major input (e.g., emission factors) of the version of the model used to produce emission estimates in the Nonroad Diesel Engine NPRM has been reviewed by two individual, external, independent experts, as required by the EPA's Peer Review Handbook (Science Policy Handbook: Peer Review, 2nd Edition, December 2000, EPA 100-B-00-001). Due to the complex nature of the model and the nearly continuous work to improve the model as additional data become available, the peer review process for the model has been an evolutionary one that has taken several years.

EPA had a forerunner of the NONROAD model that had inputs and a structure similar to that of NONROAD peer reviewed as part of the Tier 2 and 3 Nonroad Compression Ignition Engine Rule in 1998. Much of NONROAD was based on this predecessor. EPA entered these comments and responses to them into rule docket A-96-40.

In 1998, EPA had the Nonroad Small Spark-Ignited Engine Emissions Model (NSEEM) peer reviewed for the Phase 2 Small Spark-Ignition Engine Rule. These comments were entered into the rule docket (A-96-55). No responses to the comments were included in the rule docket because the comments did not identify any major issues or shortcomings. The data inputs used in NSEEM were incorporated into the NONROAD Model.

In April 2000, EPA submitted the technical reports and a memorandum (NR-009a, NR-010b, and "US EPA NONROAD Model Technical Report Addenda for Tier 2 Rulemaking Version") discussing the compression-ignition (CI) and spark-ignition (SI) emission factors used in the NONROAD model for peer review. EPA made additional changes to the model and documented these changes in the memorandum, "Changes to the NONROAD Model for the April 2000 Version Used in Support of the 2007 Heavy-Duty Diesel Engine Rule". EPA submitted this memorandum for peer review in September 2000. Although the peer review information was available upon request, the results of these peer reviews were not placed in the dockets for the Tier 2 and 2007 Heavy-Duty Diesel Rules because these rules applied to on-highway emissions for which the NONROAD Model played only a supporting role in estimating the nonroad portion of the total inventory.

From late 2000 to mid 2003, EPA continued to work toward getting all of the major aspects of NONROAD peer reviewed. EPA completed peer reviews for the most recent CI and SI engine emission factors and deterioration rates, growth rates, evaporative and refueling emissions, activity rates, load factors, median life, CI and SI engine populations, CI and SI engine deterioration rates, allocation factors (i.e., geographic, seasonal, and week day/weekend day), and several memoranda concerning changes made to NONROAD inputs for the Recreational/Large SI Engine Rule and the proposed Nonroad Diesel Engine Rule. EPA has placed a summary and analysis of the CI-related peer review comments in the Nonroad Diesel Engine Rule docket. The SI-related peer reviews were not completed in time to prepare a summary and analysis to be entered into the docket before promulgation of the final Recreational/Large SI Rule, but these comments will be made available as soon as possible.

As significant changes to the NONROAD Model occur, EPA will continue to undertake additional peer reviews, and these will be made available to EPA stakeholders via a docket or some other public means.

Exclusive Consideration Given to States Is Inappropriate

EPA properly entered the draft NONROAD2002 model, its supporting documentation, and the input files used to produce emission estimates for the Control of Emissions of Air Pollution from Nonroad Diesel Engines and Fuel rule proposal into the public docket A-2001-28, as per required by administrative procedures. In addition, EPA gave the States a preview of the NONROAD2002 model because of their role as co-regulators with EPA.

NONROAD2002 Is Still in Draft Form and There Are Significant Data Gaps

EPA is confident that NONROAD2002 produces reasonable emission inventory estimates suitable for consideration in the rulemaking. As part of this rulemaking and previous rulemakings (i.e., the Recreational and Large Spark-Ignition Engine, Heavy-Duty On-Highway Diesel and, Tier 2 Rules), the NONROAD model has been extensively quality assured and many improvements have been made to the model. Peer reviews also have been completed on all the major aspects of the model. Also, EPA's confidence is reflected in the fact that EPA has issued guidance allowing states to use draft NONROAD2002a for their official State Implementation Plan submittals.

The lack of running loss and hot soak VOC in the model does not adversely impact the nonroad diesel rule, since these types of emissions are negligible in diesel engines. In regard to air toxics not being a part of NONROAD2002, EPA calculated these emissions for the rulemaking using air toxic VOC fractions used in the development of the National Emissions Inventory. Links to the documentation for the NEI can be found on the EPA's Office of Air Quality Planning and Standards website at http://www.epa.gov/ttnchie1/net/neiwhatis.html.

2.3.2.2 Data Sources

2.3.2.2.1 Inconsistent Basis for Costs and Benefits

The comments in this section can be summed up as-
EPA's use of the NONROAD model to estimate projected benefits and the use of fuel consumption projections from EIA to estimate projected costs led to underestimation of the costs of the proposed rule relative to the emission reductions, as well as monetized benefits of the proposed rule.

What Commenters Said:

API and Marathon commented that the methodology for determining cost-effectiveness is problematic since the NONROAD fuel consumption estimates are overstated- EPA employed two different methodologies for estimating the emissions/fuel consumption impacts of the proposed nonroad rule and the associated cost impacts. Chapter 3 of the RIA presents the emissions inventory and fuel consumption impacts of the proposed rule, which are derived from the NONROAD model. In Chapter 7 of the RIA, diesel fuel use data by end-use sector for the year 2000 are based on the EIA report Fuel Oil and Kerosene Sales 2000. The year 2000 fuel consumption estimate for land-based nonroad diesel engines as derived using the Chapter 7 methodology is 27.1 percent lower than the fuel consumption estimate developed in Chapter 3 using the NONROAD model. EPA states that the fuel consumption estimates in Chapters 3 and 7 differ by approximately 15 percent. However, it is unclear how this percentage was calculated, since analysis of the data in Chapters 3 and 7 suggests that the discrepancy is nearly twice as large as that stated by EPA. API also provided a figure that illustrates the difference between the estimates in Chapters 3 and 7, and asserts that if the NONROAD estimates are overstated, this implies that EPA's estimates of the cost per ton of pollutant reduced as presented in chapter 8 of the RIA, are substantially understated.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 39-41
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 35-37

API and Marathon further commented that EPA's estimates of emissions benefits should include some element to account for uncertainty. EPA's proposal estimates the benefits of its proposal in calendar year 2025 for diesel powered agricultural equipment based on the assumption that this sector would grow at an annual rate of 2.9 percent from 1996 onward. If EPA had based its projections on a forecast of farm-based economic indicators such as the 1.3 percent annualized rate of change in "Value of Agricultural Shipments" shown in Table 32 of the EIA, 2003 Annual Energy Outlook, the estimate of the emissions benefit of its proposal for this class of equipment would have been reduced by approximately 25 percent in 2025. This degree of uncertainty in the emissions benefits should be included in the overall assessment of the social costs and benefits of the proposed rule.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 43
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 39-40

Our Response:

For background purposes, we presented the fuel consumption estimates used to project SO_2 and for sulfate PM emission reductions associated with the proposed rule in Table 3.1-8 of the Draft RIA. These fuel consumption estimates were also implicit in the other pollutant benefits projected, in that nonroad equipment only emit pollutants when they are being operated (i.e., burning fuel). More or less fuel consumption inherently means more or less emissions, other factors being equal.[3]

We presented a second set of fuel consumption estimates in Tables 7.1-14 and 7.1-16 of the Draft RIA. These fuel consumption estimates were derived from the EIA FOKS and EIA AEO 2002 and were used to estimate per gallon fuel costs. For locomotive and marine diesels, the EIA-based fuel demands are very similar to those presented in Table 3.1-8 of the DRIA. However, for land-based nonroad equipment, the EIA-based fuel consumption for 2000 is roughly 20% lower than that from the NONROAD model (i.e., the NONROAD estimate is 25% higher than the EIA-based estimate).

Secondly, as shown in Table 3.1-8 of the Draft RIA, NONROAD projects that fuel consumption will grow at roughly 3% per year. In contrast, EIA's AEO 2002 projects that non-highway diesel fuel will grow much more slowly. Using the growth rates from AEO 2002, land-based nonroad fuel demand would only grow by 1.2% annually, or less than half the rate projected by the NONROAD model.

Regarding the first point, we pointed out in the NPRM that the underlying nonroad fuel consumption behind the emissions projections differed from that used to calculate costs. We did not believe this inconsistency affected the outcome of our cost effectiveness and cost-benefit comparisons which were used to evaluate the proposed rule. And, we committed to reconcile this difference for the final rule. Therefore, as discussed further below, we will use the NONROAD model to estimate costs, benefits, and emission reductions related to the final rule. In addition, we have performed a sensitivity analysis to ensure that the final rule is still appropriate given the possibility that the NONROAD model may be overestimating fuel consumed (and thus, emissions) by nonroad equipment. See RIA Chapter 8 Appendix A.

2.3.2.2.2 Historical and Current Nonroad Fuel Demand

The comments in this section can be summed up as-
The NONROAD model overestimates the current emissions from land-based nonroad equipment and thus, the emission reductions attributable to the proposed rule. Adjusting NONROAD fuel consumption (and thus, emissions) to match a level consistent with EIA's Fuel Oil and Kerosene Sales Report (FOKS) would produce more accurate estimates of emissions and associated emissions benefits.

What Commenters Said:

EMA commented that there is a wealth of fuel consumption data that EPA has not considered for the development of NONROAD or the model's input data. EIA conducts annual surveys to determine current fuel consumption by economic sector. EIA also completes computer modeling to forecast future fuel consumption needs. The commenter provided additional discussion on the sources of EIA data (e.g. EIA-821 as reported in the annual publication Fuel Oil and Kerosene Sales, and the National Energy Modeling System (NEMS)) as well as discussion, tables, and a graphic that compare diesel consumption

[3] While other factors (e.g., emission deterioration rates) might be revised and compensate for any change in fuel consumption, these factors are independent of those affecting fuel consumption and are addressed elsewhere in this section of the S&A document.

estimates between the NONROAD model and EIA estimates to show that the latter can provide a more accurate representation of these estimates through the year 2030. EMA also provided additional discussion on alternative sources for growth rates in the context of application types such as railway maintenance and aircraft support, that are included in the NONROAD model but not necessarily represented in the same manner in the EIA data sources.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 96-99

API and Marathon commented that the NONROAD model consistently overestimates nonroad diesel fuel consumption relative to the EIA data in every year and also overstates the historical trend in nonroad diesel fuel use. API also provided a figure that shows a comparison of the slopes of simple linear trends fitted to the EIA and NONROAD model data. This comparison shows that the NONROAD model overestimates the rate of growth in nonroad diesel fuel consumption between 1995 and 2001 by approximately 60 percent. This discrepancy will significantly impact long-term inventory projections because of the approach used by EPA to extrapolate activity based on historical trends.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 44-45
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 40-41

API and Marathon also commented that EPA applies the 1.9 percent annual growth rate developed from the NONROAD model to forecast fuel consumption through 2040, but provides no rationale to support the use of this growth rate as opposed to the significantly lower annualized growth rate of 0.9 percent as derived from the EIA Annual Energy Outlook 2002. The NONROAD model growth rate is simply based on a linear extrapolation of historical data from the period 1989 to 1996. EPA should accept the EIA data, which is more sensitive to assumptions concerning future economic activity.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 39-41
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 35-37

Our Response:

In summary, fuel consumption estimates based on EPA's analysis of EIA's FOKS reports and EPA's NONROAD emissions model differ. Available independent surveys of distillate fuel used outside of the nonroad sector tend to confirm the FOKS results for these sectors (residential, locomotive, commercial heating, and farm). However, issues exist concerning how FOKS addresses jet fuel being shifted to the distillate market during distribution. Because of this, and other uncertainties surrounding FOKS and our use of these survey results in estimating nonroad fuel consumption, we are not sufficiently confident that the FOKS-based estimates of nonroad fuel consumption is more accurate than the historical estimates of nonroad fuel consumption in the NONROAD emissions model. Therefore, for this rulemaking, we will continue to base historical estimates of nonroad fuel consumption on the NONROAD emissions model.

We have also performed a sensitivity analyses (see Appendix A of Chapter 8 of the Final RIA) in which we estimate the costs, emission reductions, and cost effectiveness for the final rule; assuming that our estimates of nonroad fuel consumption derived using FOKS are correct. This sensitivity analysis also incorporates future growth rates from EIA's 2003 Annual Energy Outlook (AEO), as discussed in Section 2.3.2.2.3 below. The results of this sensitivity analysis are summarized in Table 2-1 below.

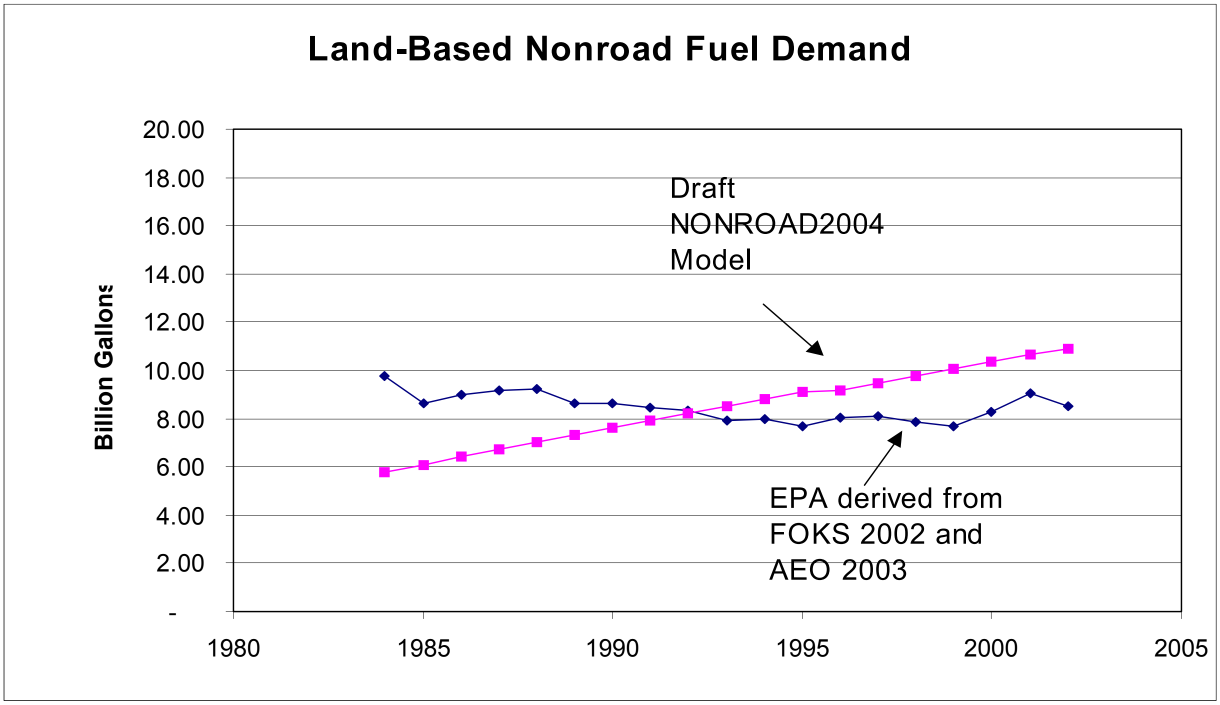
Table 2-1. Aggregate Cost per Ton Estimates for the Nonroad Final Rule
Nonroad Fuel Consumption Using Two Different Methodologies
30-year Net Present Values at 3 percent Discount Rate ($2002)

Pollutant	EPA Draft NONROAD2004	Derived from EIA FOKS/AEO 2003
NOx+NMHC	$1,010	$1,490
PM	$11,300	$15,900
SOx	$710	$910

The lower fuel consumption estimates derived from EIA's FOKS and AEO 2003 reduces projected emission reductions associated with the final rule and fuel-related costs by roughly the same degree. However, engine-related costs remain unchanged. Therefore, the ratio of costs to emission reductions increases. As can be seen in Table 2-1, the increase is greatest for NOx+NMHC, as these pollutants are controlled through aftertreatment and the costs to control these emissions are dominated by engine-related costs. The cost per ton estimate for SOx emissions falls at the other extreme, since these emissions are dominated by fuel-related costs. In all cases, the cost per ton estimates using the nonroad fuel consumption estimates derived from EIA FOKS and AEO 2003 fall within acceptable ranges for mobile source emission control. See, e.g., 68 FR at 28449 (Tables V.D.3 through V.D.5). Thus, even if we used the nonroad fuel consumption estimates derived from EIA FOKS and AEO information, as the commenter suggests, the results would not change our decisions regarding the requirements of this final rule.

Moving to a detailed description of our response to the comments in this area, Figure 2-1 depicts historical estimates of fuel consumption by land-based nonroad equipment from EPA's NONROAD emission model and from our analysis of the estimates of distillate fuel demand from EIA FOKS reports. It should be noted that FOKS does not directly survey the use of distillate fuel in nonroad equipment. This estimate must be derived from the estimates of fuel demand from various economic sectors, some of which clearly do not involve the use of nonroad equipment, some almost entirely represent fuel use in nonroad equipment and some are a mixture of the two. Judgment must be used to estimate the fractions of nonroad fuel use among the various sectors. Therefore, we refer here to nonroad fuel consumption estimated using the information obtained through FOKS as "derived from FOKS" (by EPA) and not as a "FOKS estimate." The two sets of fuel consumption are analogous to those presented in Section 7.1 of the Draft RIA. However, the estimates shown in Figure 2-1 have been updated to reflect the draft NONROAD2004 model and FOKS 2002.

Figure 2-1



As can be seen, the two sets of fuel consumption differ, particularly in their trends over time. The EIA-based estimates show very little change between 1985 and 2002, while NONROAD shows a steady increase in fuel demand for this equipment. To better understand the reasons behind this difference, it will be helpful to review the information used to develop the EPA NONROAD model, as well as the approach EIA uses to develop its fuel sales estimates.

Nonroad Fuel Demand from Draft NONROAD2002/2004

EPA's NONROAD model projects emissions (or fuel consumption) using estimates of:

1) equipment population,
2) engine size (horsepower (hp)),
3) equipment activity,
4) average engine load and
5) brake-specific emission factors (and fuel consumption).

When combined multiplicatively for sub-groups of equipment, with appropriate consideration of units, the result is an estimate of total emissions and fuel consumption for the specified geographic area.

There is considerable interdependence between equipment population and the other factors listed above, because independent estimates of equipment population at the desired level of disaggregation are not available. Thus, equipment populations are projected from estimates of equipment sales and scrappage. Scrappage depends on the median life of the equipment in years, which is derived from estimates of median engine lives in terms of hours of use at full load. These full-load engine lives are then converted to median equipment lives in years using annual equipment activity and average engine load. Thus, annual equipment activity and average engine load have a strong influence on equipment population estimates, as well as direct influence on fuel usage estimates and estimated emissions for the nonroad equipment fleet. Independent verifications of the various inputs to NONROAD will also be evaluated. (For a complete description of how the NONROAD model was developed and its operation, the reader is referred to EPA's documentation of the series of NONROAD models which are contained at its website (www.epa.gov/otaq/nonrdmdl.htm). A brief description of NONROAD's operation can also be found in Ch. 3 of the Draft RIA. The description presented below will only provide an overview in order to focus on those aspects of the model most relevant to the issue of total activity as indicated by fuel consumption.)

Unlike EPA's series of MOBILE models, NONROAD projects absolute emissions for a specified geographic area. MOBILE6.2, for example, projects emission factors in terms of grams of pollutant per mile, which are then coupled with estimates of "vehicle miles traveled" (VMT) from other sources, such as the Federal Highway Administration (FHwA) or state and local transportation agencies. In order to project these fleet-average emission factors, MOBILE6.2 utilizes estimates of the relative number of vehicles of various model years in the vehicle fleet (i.e., the vehicle registration distribution, again a function of sales and scrappage) and the typical number of miles that various types of vehicles are driven per day or year and how this mileage varies with age. However, the use of independent estimates for vehicle miles traveled and registration distributions (and in many cases, direct surveys of annual vehicle mileage accumulation rates) eliminates the need to estimate the size of the absolute vehicle population in any particular local area or in the nation as a whole.

NONROAD, on the other hand, does not utilize any independent estimates of equipment populations or measures of activity, such as hours of use or fuel consumption. This is primarily due to the fact that such estimates only exist for subsets of the nonroad equipment population (e.g., agricultural tractors, some types of construction equipment) or for the fuel consumption by broad sectors of the economy (e.g., industrial, commercial, construction, etc.). Engine emission standards applicable in a specific model year often vary by horsepower, so EPA desires to have an emission model which is sufficiently detailed to reflect these differences. The available estimates of in-use nonroad equipment population and fuel consumption contain no breakdown by equipment type, engine horsepower or equipment age.

Thus, in order to produce emission estimates broken down by equipment model year and engine horsepower that can reflect the level of detail inherent in EPA's emission standards, EPA estimates in-use equipment populations (by equipment type and horsepower range) from estimated equipment sales and scrappage. During a simulation, NONROAD estimates the amount of each pollutant emitted (and fuel consumed) on a brake-horsepower-hour basis. NONROAD estimates the total amount of emissions produced or fuel consumed in a state or the nation by multiplying equipment populations by estimates of annual activity (i.e., hours per year), mean power rating and load factor for each equipment type. Equipment populations and emissions are broken down for geographic areas below the national level using economic factors, such as construction expenditures, farm acreage, building square footage, etc. It will be useful to briefly review how the estimates for each of these factors were derived in order to better understand their accuracy relative to the EIA FOKS fuel consumption estimates. The list of factors is:

1) Equipment Population
2) Equipment Life

3) Equipment Life and Scrappage
4) Engine Median Life
5) Engine Load Factors
6) Annual Equipment Activity
7) Selected Median Equipment Lives
8) Scrappage Function
9) Base Year Equipment Population Calculation
10) Engine Horsepower
11) Total Activity
12) Fuel Consumption

Equipment Population: NONROAD projects future or past emissions and fuel consumption on the basis of simulated changes in equipment populations. Population estimates for the base year are provided to the model in input files. When the NONROAD model is run, growth rates are applied to forecast or backcast future or past equipment populations, respectively. These growth rates are based on trends in populations estimated from sales histories and are discussed in more detail below. For now, the issue is historical fuel consumption, which is best addressed by focusing on how the base year equipment population is developed.

Equipment population is developed for a single base year (1998 in Draft NONROAD2002, which was used for the NPRM, 2000 in Draft NONROAD2004, which is used for the FRM). Base-year populations are developed by summing up past sales and applying scrappage rates. This step is performed outside the model, and the resulting base-year populations are supplied as inputs to NONROAD.

We obtained estimates of annual equipment sales by equipment type and horsepower from Power Systems Research (PSR). Some manufacturers provide actual sales data to PSR. However, for other manufacturers, PSR must estimate sales based on other information.

Sales estimates for some equipment types are available for as far back as 1975. Sales trends are used to backcast sales to 1975, when sales estimates are not available back to this date. Sales are backcast further to 1948 by assuming constant sales at 1975 levels. As these estimates apply to sales of diesel-powered equipment, any extrapolation of sales prior to 1975 is done assuming that the diesel fraction of historic equipment sales is constant at the 1975 level.

Equipment Life: In estimation of base-year populations (and future equipment populations, as well), equipment life is assumed to be equal to the life of the engine. NONROAD starts with estimates of engine life at full load (in hours) and adjusts these "full-load lifetimes" to reflect more realistic in-use operating conditions. Specifically, engine life at full load is divided by the average load factor of the relevant equipment type to produce an estimate of actual engine life (in hours). Then, the median engine (and thus, equipment) life in years is determined by dividing actual engine life (in hours) by annual activity (in hours per year). For example, equipment with an average load of 20% is projected to last five times as long as the same equipment (and engine) with an average load of 100%. Likewise, equipment used 100 hours per year will last twice as long (in terms of years) as the same equipment used 200 hours per year.

Equipment Life and Scrappage: Equipment scrappage rates are based on the projected median life of the original engine in terms of years. The NONROAD methodology assumes that nonroad engines are not rebuilt. However, equipment is also assumed to never fail before the engine is worn out. To the degree that engines are actually rebuilt in the nonroad equipment fleet, NONROAD would underestimate the in-use equipment population. In contrast, should the equipment wear out or be damaged before the engine wore out, NONROAD would overestimate the in-use equipment population.

Engine Median Life: The median life of nonroad engines is based on estimates of the expected life of highway diesel engines operated continuously at full load. Median engine lives are estimated for three nonroad engine categories:

1. Engines rated at less than 50 hp: median life of 2,500 hours at full load (estimated life of a light-duty, highway diesel engine)
2. Engines rated at 50-300 hp: median life of 4,667 hours at full load (assumed to be 2/3 of the estimated life of a heavy-duty, highway diesel engine)
3. Engines rated at more than 300 hp: median life of 7,000 hours at full load (estimated life of a heavy-duty, highway diesel engine)

The estimated median life of a nonroad diesel engine does not vary by manufacturer, engine design (e.g., turbo-charged, after-cooled, indirect or direct injection, etc.), equipment type, etc.

In Draft NONROAD2002, we substituted engine lifetimes based on highway engine experience for those estimated by PSR. A study performed for the California Air Resources Board (CARB) developed the above estimates of highway engine lifetimes for use in their OFFROAD emissions model, which they use to estimate in-use emissions from nonroad equipment. The study also made a number of adjustments to these estimates to reflect differences in the design and operation of highway and nonroad diesel engines. These adjustments reduced the three lifetimes shown above to 1,250-2,500[4], 4,000 and 6,000 hours, respectively, for the three engine classes. In developing Draft NONROAD2002, we accepted the CARB estimates of highway engine lifetimes, but rejected the downward adjustments, since the latter were not based on data and we believed the logic explaining different lifetimes for nonroad and highway engines to be flawed.

Load Factors: The load factor in the NONROAD model addresses the fact that engines do not operate 100% of the time at rated speed and rated horsepower. The load factors in the Draft NONROAD2002 and Draft NONROAD2004 models are based on 7 operation cycles developed by the Southwest Research Institute (SwRI) for EPA. Three of the cycles, those for agricultural tractors, backhoe-loaders, and crawler tractors, were developed by having professional operators perform a series of specified tasks believed to be typical for that type of equipment. One piece of equipment was tested from each category and each piece of equipment was tested for 8-20 hours of operation. The three cycles were developed from selected micro-trips (operations to perform specific tasks).

The other four cycles, those for skid-steer loaders, arc welders, wheel loaders, and excavators, were developed using rental equipment equipped with on-board data loggers. A total of 5 pieces of equipment were tested for a total of 123 hours of operation. The cycles were developed from the total universe of measured operational data.

[4] 1,250 hours for engines less than 16 hp, 2,500 hours for engines between 16 and 50 hp.

The seven cycles yielded average load factors ranging from 0.21-0.78. Since operating cycles were not developed for every type of equipment (NONROAD includes about 80 equipment types), we grouped the seven cycles into three categories (transient cycles with relatively high load factors, transient cycles with relatively low load factors and steady-state cycles). The load factors of the cycles assigned to each category were arithmetically averaged.

- High, transient load factor: 0.59 (average of 4 cycles (agricultural tractor, crawler dozer, rubber-tire loader, excavator) with load factors ranging from 0.48-0.78)
- Low, transient load factor: 0.21 (average of 3 cycles (backhoe/loader, skid-steer loader, arc welder) with load factors ranging from 0.19-0.23)
- Steady-state load factor: 0.43 (average of all seven transient cycles)

Each type of nonroad equipment was assigned to one of the three load factor categories. The seven types of equipment tested were assigned to the high or low transient grouping that its cycle was used to develop. Other equipment were assigned to load factor groups based on engineering judgment.

Annual Activity: Estimates of the annual activity of various types of equipment are obtained from PSR, who in turn develops them from periodic surveys of nonroad equipment users. The methodology used by PSR to determine who is surveyed, as well as the way the survey results are compiled is proprietary. The annual activity estimates vary by equipment type, but not by engine size or age or model year. The insensitivity of annual activity to both equipment size and age make it important that the sample of users surveyed by PSR be representative, as activity in the field may vary versus these parameters. Due to the proprietary nature of the sampling performed by PSR, we cannot assess the representativeness of the sampling.

Selected Median Lifetimes: Table 2-2 depicts annualized median life estimates for selected equipment types in NONROAD (in order from shortest lived to longest).

Table 2-2
Selected Median Equipment Lives in Draft NONROAD2002/2004 (years)

Equipment Type	Load Factor	Activity (hrs/yr)	Median Equipment Life (years)		
			Engine < 50 hp	Engine 50-300 hp	Engine >300 hp
Fork Lift	0.59	1700	2.5	4.7	7
Off-highway Truck	0.59	1641	N/A	5	7
Refrigeration/AC	0.43	1341	4	8	N/A*
Crawler	0.59	936	4.5	8.5	13
Ag Tractor	0.59	475	9	17	25
Backhoe	0.21	1135	10	20	N/A
Skid-Steer Loader	0.21	818	15	27	N/A
Generator Set	0.43	338	17	32	48
Welder	0.21	643	18.5	35	N/A
Other Material Handler	0.21	421	28	53	79
Combine	0.59	150	N/A	53	79
Pressure Washer	0.43	145	40	75	112

* N/A: Equipment with that engine horsepower are not produced for sale.

As can be seen from the table, the estimated equipment life can be very short for equipment with small engines, high activities and high load factors (e.g., 2.5 years for fork lifts with engines rated at less than 50 hp) and very long for equipment with large engines, low activities and mid to low load factors (e.g., 75-112 years for pressure washers fork lifts with 50+ hp engines).

Scrappage Function: The percentage of a model year's equipment which is scrapped in any given year is estimated using a normal distribution with a standard deviation equal to half the estimated median life (in years). According to this equation, the peak annual scrappage rate occurs at the median life. Also, 50% of the equipment is still in-use just as the median life is reached. Equipment starts being scrapped a few years prior to this and has been completely scrapped by twice the median life (e.g., two standard deviations beyond the mean). Weibull distributions are most commonly used to estimate the life of mechanical parts and equipment.[5] However, the information necessary to fully utilize the flexibility afforded by Weibull distributions are not available.

Engine Horsepower: NONROAD breaks down each type of equipment into a number of horsepower ranges (e.g., 0-6 hp, 7-11, 12-16, 17-25, etc.). These groupings were developed to represent differences in applicable emission standards. Where possible, they also represent natural breaks in the distribution of engine sizes used in nonroad equipment. The average engine horsepower for each range of horsepowers for each type of equipment is based on sales estimates provided to EPA by PSR for 1990-2000 model years. This average horsepower is then used for all past and future model years.

Total Activity: NONROAD multiplies the estimated in-use equipment population for each combination of equipment type and engine size by the annual activity, horsepower and load factor for that combination of equipment type and engine size to estimate the total annual activity for that combination (in terms of brake-horsepower-hours per year).

Fuel Consumption: The final step in development of the NONROAD model is to estimate brake-specific emission and fuel consumption rates (mass or volume per brake horsepower-hour) and apply this to the level of total activity described above (e.g., the product of population, activity, mean rated power and load factor). Since fuel consumption is the only focus here, we will not describe the development of brake specific emission factors.

Brake-specific fuel consumption in NONROAD is estimated to be 0.408 lb/bhp-hr for engines rated at 100 hp or less and 0.367 lb/bhp-hr for engines rated over 100 hp. These figures are based on the fuel consumption as measured during nonroad engine certification and thus, represent those over the EPA certification test cycle. Fuel density is estimated to be 7.1 lb/gal, based on various in-use fuel surveys, such as those conducted by the Alliance of Automotive Manufacturers (and its precursors) and the National Institute for Petroleum and Energy Research (now conducted by TRW).

One of the interesting technical features of the way NONROAD estimates total activity, and thus, emissions and fuel consumption, is the way changes to certain factors have little impact on total emissions or fuel consumption. The reason for this insensitivity is that changes in inputs such as activity and load factor must be reflected in both the estimation of base-year population inputs (developed outside the model) and in the estimation of equipment activity, fuel consumption and emissions during model runs. For example, reducing the annual activity level of a type of equipment has little impact on the total projected emissions or fuel consumption by that type of equipment. Reducing the annual activity lengthens equipment life (in years), since equipment life is equal to engine life divided by the product of annual activity and load factor. Longer equipment life, at the same level of sales, leads to larger in-use equipment populations, since equipment scrappage has been reduced. Since the two changes occur roughly to the same proportion, the net effect is very little change in emissions or fuel consumption. Changing the load factor would have a similar non-effect, since equipment life also changes inversely in proportion to any change in load factor.

Thus, reducing the load factors in NONROAD would have very little impact on total emissions or fuel consumption, due to compensating changes in total equipment populations in the base year. However, should independent estimates of equipment population be developed, then changing load factor would directly impact NONROAD's projected emissions and fuel consumption.

<u>*Nonroad Fuel Demand Derived From EIA's Fuel Oil and Kerosene Survey (FOKS)*</u>

EIA conducts an annual survey of fuel distributors to assess the volume of distillate fuels used in a wide variety of economic sectors. EIA surveys roughly 4,700 fuel distributors, which are selected using statistical sampling criteria. Each distributor is asked to estimate the volume of distillate fuel that he sold in various fuel use categories. The specific categories tracked by EIA are:

Highway vehicles
Marine vessels
Oil Company
Industrial
Off-highway (Construction)
Military
Railroad
Farm
Electric Utility
Commercial
Other off-highway (logging, etc.)

Some of these categories are also broken down further into various types of distillate fuel. For example, commercial fuel is broken down into low sulfur diesel, high sulfur diesel, high sulfur fuel oil and kerosene. Most categories with some use of No. 4 fuel oil break out this fuel separately.

Distributors primarily estimate the use of the fuel which they sell based on the primary business of the fuel purchaser (e.g., fuel purchased by a construction firm is off-highway fuel, fuel purchased by an individual home owner is residential fuel, etc.). Given that FOKS categorizes fuel use by economic sector, it is usually possible to place an individual or a firm clearly into one category or another. While some distributors likely use actual sales records to respond to the survey, others may provide more approximate estimates.

The FOKS sampling method is statistically designed to cover the sale of fuel to all but two of the categories listed above: highway vehicles and electric utilities. Instead, EIA substitutes highway fuel sales estimates from the Federal Highway Administration. The FHwA estimates are based on fuel tax receipts, minus requests for highway excise tax refunds from those who purchased highway diesel fuel for use in non-highway applications. EIA obtains more accurate distillate fuel use estimates for electric utilities from the Federal Energy Regulatory Commission (FERC) and adjusts their fuel use estimates accordingly. Finally, EIA also adjusts their fuel use estimates to match the total volume of distillate fuel supplied from both domestic refiners and importers (per EIA's *Petroleum Supply Annual* reports).

Because of these adjustments, EIA publishes two sets of fuel use estimates. The first is labeled "unadjusted," but includes estimates of on-highway fuel usage adopted from FHwA. The second set of volumes are labeled "adjusted" and include improved electric utility usage as adopted from FERC, as well as adjustments to match the total volume of distillate fuel supplied to the U.S. market. We believe that the adjusted estimates are the more relevant for our purposes, as the FERC usage estimates are widely recognized as representing improvements and provide closure between total product supplied and total sales.

As noted above, EIA categorizes distillate fuel use into eleven sectors. Distillate fuel in three of these sectors (farm, off-highway (construction) and off-highway (other)) represents fuel used primarily in what EPA defines as land-based nonroad equipment. Significant quantities of commercial and industrial fuel are also likely used in land-based nonroad equipment. Very little fuel use in the remaining sectors likely involves land-based nonroad equipment. Because fuel use in land-based nonroad equipment as defined by EPA is not directly tracked in FOKS, the FOKS estimates must be processed to produce an estimate of fuel use in land-based nonroad equipment which is comparable to Draft NONROAD2004.

The methodology which we use to derive land-based nonroad fuel use from FOKS estimates is described in Section 7.1.5 of the Final RIA. We applied that methodology here to the 2002 FOKS results.[5] The basic methodology used and the results are summarized in Table 2-3. The last line in Table 2-3 shows the total land-based nonroad fuel consumption as estimated by EPA's Draft NONROAD2004 emission model described in Chapter 3 of the Final RIA. As is shown, the difference in nonroad fuel consumption using the two methodologies is 2.4 billion gallons in 2002.

[5] The analysis in Section 7.1.5 of the Final RIA utilizes estimates from 2001 FOKS. FOKS 2002 was only released in November, 2003. The RIA analysis had to be completed on an earlier schedule that this analysis of comments to allow the completion of other analyses which depended on its results.

Table 2-3
Distillate Fuel Demand from EIA FOKS 2002 (million gallons per year)

Sector	Total No 2 Distillate Fuel	Land-Based Nonroad *	
		"EPA Nonroad" Factors (%)	Estimated Nonroad Fuel
Residential	5,928	0%	-
Commercial	3,065	100% of high sulfur diesel fuel 20% of kerosene	491
Industrial	2,238	100% of high sulfur diesel fuel 40% of No. 1 distillate fuel	1,883
Oil Company	825	50% of no. distillate	413
Farm	3,179	100% of diesel fuel	3,109
Electric Power	634	0%	-
Railroad	3,081	0.95%	29
Vessel Bunkering	2,070	0%	-
On-Highway	34,309	0.7%	240
Military	331	85% of diesel fuel	258
Off-Highway	2,224	95%	2,116
US Total	57,884	---	8,537
US Total: EPA NONROAD			10,920

* Per EPA methodology described in Section 7.1.5 of the Final RIA.

As mentioned above, FOKS is a survey and the results are subject to uncertainty. While independent estimates of nonroad fuel use do not exist to verify the nonroad fuel consumption estimates in Table 2-3, some independent data exist to verify the total distillate fuel consumption estimates for some of the economic sectors covered by FOKS. These independent data are examined below.

Independent Verification of NONROAD and FOKS Estimates

NONROAD Emission Model

The wide variety of the types of nonroad equipment, their varied uses and the lack of state registration makes it extremely difficult to obtain representative estimates of in-use equipment populations and its operation. Regarding sales projections, to date, EPA has utilized only industry-wide totals from PSR, not broken down by manufacturer. Thus, it is not a simple task to try to confirm or improve those sales figures which must be estimated by PSR. Sales data for on-road vehicles can generally be considered to be quite accurate, as they are tracked by a number of external parties and vehicles are registered in every state. Nonroad equipment sales are not tracked as carefully, and there are no state or federal registration requirements (other than some limited equipment registration requirements in California). Thus, there is some degree of uncertainty in exactly how many pieces of equipment of each type and horsepower are sold each year. As part of the engine certification process, EPA receives projections from manufacturers of their upcoming year's production of engines which is directed to the U.S. market. However, being projections, they do not always match eventual sales. Thus, the uncertainty in the sales estimates cannot be estimated quantitatively.

Regarding equipment life, no data are available regarding the actual life of nonroad equipment. Likewise, there is a similar lack of available data with which to verify the inputs to EPA's estimation of equipment life (i.e., the estimated lives of the three categories of highway diesel engines at full load and rated speed, the extrapolation of these highway diesel engine lives to nonroad engines, the premise that engine life is a reasonable surrogate for equipment life, and the assumption that equipment life varies inversely proportional to average engine load). Given the fact that we expect nonroad diesel engines to be designed to be at least as robust as highway diesel engines, with respect to durability, we have confidence in our approach of using engine life as a surrogate for equipment life.

Regarding average load factor, due to the methods used to develop and apply the seven cycles, it is not possible to assess their absolute accuracy with respect to actual average in-use operation. The agricultural tractor, backhoe loader, and crawler tractor cycles only included pre-determined operation. While the specific tasks assigned to these equipment are believed to be quite typical, there is no way of assessing the representativeness of the amount of idle time included, the distance of travel to and from the area where the tasks were performed, the resistance associated with the task (e.g., hardness of dirt, weight of the load, depth of the dig, etc.). However, there is no indication that the operation was atypical. In fact, given the involvement of the engine manufacturers' technical staff in helping to determine the microtrip weighting for the cycles and confirming the component activity sets for the duty cycles, we have some measure of confidence in the accuracy of the composite application duty cycles. The skid-steer loader, arc welder, wheel loader, and excavator data are based on actual day in the life operation without regard to incorporating targeted activity, since their operation was under the control of the renter. However, only a small amount of operation and limited sets of applications, size ranges, etc. were sampled. Most of the equipment was by design "rental", which itself only represents a portion of nonroad equipment use. We were able to obtain owner operator equipment for some of the applications, however in all instances, the operation was conducted by experienced operators. Unfortunately, due to the proprietary nature of the PSR process, and the lack of comprehensive and detailed alternative data sources, we are not able to make an independent assessment of representativeness. As detailed above, we have provided discussion in niche areas for which we have been able to access alternative data sources, but broad, sweeping changes based on a fully documented, comprehensive alternate source is not possible. We have however confirmed the type of operation is consistent with operation from similar applications in Europe. This is confirmed by the adoption of the nonroad transient duty cycle for nonroad mobile machines in European Directive 2004/26/EC.

Regarding annual activity, no publically available data are available to confirm the PSR estimates. Measuring average annual activity would actually be a difficult task to perform. Measuring the activity of an individual piece of equipment is relatively straightforward. Most equipment have usage meters, which show the number of hours that the engine has been operating and which could be read periodically. However, measuring every piece of nonroad equipment in-use would be impractical. Any sample of equipment would need to be representative of all equipment of that type. This is difficult to achieve, as it is very difficult to ascertain where all the equipment is located at a given point in time, its current usage pattern, etc. Unless such sampling was coupled with a similar effort to measure the in-use equipment population, one would need to ensure that any measurement of activity was consistent with the current estimate of the total population of equipment, which is projected using median lives and scrappage, not measured or surveyed. This should be a major consideration given to any effort to measure either in-use equipment population or annual activity in the future.

Regarding equipment life, the very limited survey data we are aware of (e.g., Construction Equipment Magazine's 1999 analysis by MacKay and Company) tends to roughly corroborate many of the construction equipment median lives used in NONROAD. We are not aware of any other survey data which directly indicate the median life of other nonroad equipment.

Regarding the shape of the scrappage function, no information is available to verify the validity of using a normal distribution, nor of the assumption coefficient of variation around the mean.

Regarding in-use equipment population, a few estimates of equipment populations for limited types of nonroad equipment are available from other sources. For example, the U.S. Department of Agriculture estimates the population of tractors and several other types of farm equipment. In general, their population estimates exceed the NONROAD populations by a significant degree. In contrast, MacKay estimates the population of several types of construction equipment and their population estimates fall below the NONROAD populations.

One difficulty in making such comparisons is that NONROAD categorizes equipment differently than USDA or MacKay, or other analysts of economic sectors. NONROAD categorizes equipment according to the primary way that type of equipment is used. For example, all generators are classified as commercial, though some may be used on farms, construction sites, etc. All skid-steer loaders are classified as construction, while this type of equipment is used in nearly every economic sector.

USDA, MacKay and, as we will see later, EIA, categorize equipment, fuel, etc. according to the type of business that the equipment user is conducting. Thus, farm equipment includes all nonroad equipment used on farms, whether the primary use of that type of equipment is agriculture or not. Individual pieces of the same type of equipment might be classified as construction, farm, industrial, etc. if it is used in all these economic sectors. Thus, one would not necessarily expect that equipment populations developed using the two different approaches to classification would yield the same result.

If independent estimates of in-use equipment populations were available for every economic sector, the totals for each equipment type could be summed and compared to the NONROAD estimates. These comparisons could then be used to evaluate if the estimated lifetime for any particular equipment types deviated dramatically from the NONROAD estimate based on engine lifetime, load and annual activity.

Regarding average horsepower of the in-use fleet, no data are available with which to evaluate the accuracy of this assumption.

Regarding the fuel consumption of in-use nonroad equipment, EPA has performed some limited in-use testing of nonroad equipment using portable, on-board devices. The purpose of this testing was primarily to demonstrate the measurement equipment and the testing procedures, though the gathering of some valid in-use data was also a goal. Of thirteen pieces of nonroad equipment so equipped, measurements of engine speed, torque, and emissions were recorded over a total of roughly 400 operating hours. Problems with the instrumentation invalidated roughly half of the data, leaving about 215 hours of validly measured operation.

The selection of the equipment and the limited amount of operation measured does not allow estimation of engine or equipment life or annual activity. However, the type of testing performed would allow the estimation of load factor and brake-specific emissions and fuel consumption. The available valid data are too limited to be used as the primary source of these estimates in NONROAD. However, the data indicate that the load factors in NONROAD for the types of equipment tested are not too low and could be too high.

Thus, overall, we have limited ability to confirm the NONROAD estimates of fuel consumption using independent estimates of either the factors involved in making these estimates or of any direct measure of in-use fuel consumption aside from FOKS, which is the focus of the next section.

EIA FOKS

Independent estimates of the fuel consumption in some of the 11 economic sectors covered by FOKS are available. Specifically, independent estimates of distillate fuel used in residential and commercial heating, industrial use and on farms and by locomotives can be compared to those of FOKS.

Most of these independent estimates of distillate fuel consumption (farm, industrial, commercial and residential) come from surveys of fuel or energy use conducted by the agencies of the U.S. government (Department of Agriculture (USDA), the Bureau of the Census, and EIA). In these cases, users of distillate fuel are surveyed, as opposed to fuel distributors, as in FOKS. Thus, the estimates are independent from FOKS. In addition, the American Association of Railroads (AAR) tracks annual fuel use by its members (i.e., railroads).

Table 2-4 shows the results of the various survey results, as well as the comparable FOKS estimate, along with the year in which the surveys were taken. EIA FOKS estimates shown have been matched to the year of the corresponding survey or AAR report.

Table 2-4
Distillate Fuel Consumption From Sources other than FOKS and NONROAD
(Billion gallons per year)

Sector	Calendar Year	EIA FOKS	User Survey	Source: User Survey
Farm	1997	3.28	3.26	USDA Census of Agriculture
Construction	1997	2.07	1.97	Census Bureau [6]
Industrial	1998	2.25	2.27	EIA Manufacturing Energy Consumption Survey, Table N3.1
Commercial	1999	1.52 [7]	1.30	EIA Commercial Buildings Energy Consumption Survey, Table C1
Residential	1997	6.45	7.72	EIA Residential Energy Consumption Survey, Table 2
Railroad	1998	3.18	3.90	AAR
Total	1997/8	18.8	20.4	

[6] U. S. Census Bureau. *1997 Economic Census,* Construction Subject Series, Industry Summary, EC97C235-15, Table 4.

[7] Total no. 1 and no. 2 distillate fuel use minus low sulfur diesel fuel use, minus no.1 kerosene use, minus high sulfur no. 2 diesel fuel use, per FOKS.

The user survey estimates of fuel consumption in the industrial, commercial, and residential sectors were taken directly from fuel oil consumption figures reported in the various EIA surveys. The estimate of locomotive fuel consumption were also taken directly from figures reported by AAR. However, the estimates for the farm and construction sectors required a number of steps in their derivation, which are described below.

USDA estimates total combined annual farm expenditures on gasoline and diesel fuel . However, the most recent estimate of diesel fuel separate from gasoline is for 1997, from the 1997 *Census of Agriculture*.[8] In 1997, U.S. farms spent $2.164 billion on diesel fuel. The average price of diesel fuel was 87.4 cents per gallon.[9] Thus, total diesel fuel consumption is estimated to be 3.26 billion gallons in 1997.

The Bureau of the Census surveys fuel expenditures in the construction industry. The latest census available, from 1997, indicates that construction firms spent $7.45 billion on gasoline and diesel fuel, $2.117 billion of which was for off-highway use. The Federal Highway Administration estimates that the construction sector consumed 300.5 million gallons of gasoline in 1997.[10] At an average price of 1.299 per gallon, this translates into a total gasoline expenditure of $3.88 million in 1997.[11] This leaves a total expenditure of $1.729 billion on diesel fuel in 1997. Using the average diesel fuel price of 87.4 cents per gallon from above, this translates into a total diesel fuel use of 1.97 billion gallons by the construction industry in 1997.

Most of the fuel consumption figures shown above for FOKS were taken directly from the applicable FOKS report (1997, 1998, or 1999). We chose to present the fuel consumption estimates after adjustment for fuel use by electric utilities and adjustments to match total demand with supply, as discussed above.

There is some question whether kerosene use as estimated by FOKS should be included or excluded when comparing to the user survey results. We chose to exclude FOKS kerosene consumption, as the user surveys tend to focus on fuel oil or diesel fuel use and include an “other” fuel category, which could include kerosene. We excluded this other fuel category when reporting the user survey results. Fortunately, kerosene use is only a small fraction of total distillate fuel use in all these categories.

Also, FOKS does not present an estimate for commercial building use, but for the entire commercial sector. This sector also includes significant fuel use in highway vehicles which are exempt from excise taxes, as well as diesel fuel which we presume is used in nonroad equipment. We assumed that the FOKS-based estimate for building use was equal to the FOKS estimate of high sulfur fuel oil use in the commercial sector. This is consistent with our methodology for deriving nonroad fuel consumption

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8 USDA, *1997 Census of Agriculture,* Table 14.

9 USDA, National Agricultural Statistics Service, *Agricultural Statistics 1999,* Table 9-

10 Federal Highway Administration, Office of Highway Information Management, Office of Policy Development, *Highway Statistics 1997,* FHWA-PL-98-020, Table MF-24.

11 Oak Ridge National Laboratory, Center for Transportation Analysis, Energy Division, *Transportation Energy Data Book, Edition 18,* ORNL-6941, Table 4.3.

estimates from FOKS results. In that methodology, we assume that all high sulfur diesel fuel in the commercial sector is used in nonroad diesel equipment. We also assume that all low sulfur diesel fuel used in the commercial sector is used in on-highway vehicles which are part of public fleets. These three fuel types (high sulfur diesel, low sulfur diesel, and No. 2 high sulfur fuel oil) comprise the great majority of the commercial sector's fuel use.

Construction Fuel Use: As shown in Table 2-4, EIA FOKS shows 100 million gallons more fuel usage in the construction sector compared to the Census Bureau. This difference is only 5% of total fuel use in this sector. Also, as FOKS provides the higher of the two estimates and construction fuel is predominantly assumed to be nonroad fuel, the Census Bureau estimate provides some indication that FOKS is not underestimating nonroad fuel use in this sector. Thus, were one to assume that the Census survey provided the more accurate fuel estimate for construction, this 100 million gallon difference would increase the total 2.4 billion gallon difference in nonroad fuel consumption resulting from the two methodologies by roughly 4%.

Commercial Building Fuel Use: As shown in Table 2-4, EIA FOKS shows 220 million gallons more fuel usage by the commercial building sector compared to the EIA user survey. This difference is 15% of total fuel use in this sector per FOKS. Also, FOKS provides the higher of the two estimates. High sulfur fuel oil is assumed to be not consumed in nonroad equipment. Thus, the user survey provides some indication that FOKS may be overestimating commercial building fuel use. For example, it may be possible that some of the high sulfur fuel oil is being consumed in nonroad equipment. Thus, it is possible that our methodology of deriving nonroad fuel use from FOKS is underestimating nonroad fuel use in this sector. This 220 million gallon difference represents about 9% of the total 2.4 billion gallon difference in nonroad fuel consumption resulting from the two methodologies.

Residential Building Fuel Use: As shown in Table 2-4, FOKS estimates residential fuel consumption to be 1.3 billion gallons per year lower than EIA's residential survey. This difference is roughly 20% of the FOKS fuel use estimate. The difference indicates that FOKS may be underestimating residential fuel use. Our methodology assumes that this sector includes no diesel fuel use by land-based nonroad equipment. Thus, if FOKS does tend to underestimate residential fuel use, then FOKS is likely overestimating fuel use in other sectors. As a whole, these other sectors are more oriented towards land-based nonroad equipment than residential. However, we cannot accurately estimate which sectors might be over-estimated, so we cannot estimate to what degree this 1.3 billion gallon difference might be leading to an overestimate of land-based nonroad fuel use per our FOKS-based methodology. However, as every other sector outside of locomotive and marine contain significant nonroad fuel usage, the effect could be significant.

Locomotive Fuel Use: As shown in Table 2-4, FOKS also estimates over 700 million gallons per year lower distillate fuel usage by locomotives than AAR. This difference is roughly 25% of the FOKS fuel use estimate. The difference indicates that FOKS may be underestimating locomotive fuel use. Our methodology assumes that this sector includes essentially no diesel fuel use by land-based nonroad equipment. Thus, if FOKS does tend to underestimate locomotive fuel use, then FOKS is likely overestimating fuel use in other sectors. As a whole, these other sectors are more oriented towards land-based nonroad equipment than locomotive. However, we cannot accurately estimate which sectors might be over-estimated, so we cannot estimate to what degree this 1.3 billion gallon difference might be leading to an overestimate of land-based nonroad fuel use per our FOKS-based methodology. However, as every other sector outside of residential and marine contain significant nonroad fuel usage, the effect could be significant.

Industrial and Farm Use: As shown in Table 2-4, the FOKS and independent survey estimates are essentially identical for these two sectors. Our methodology assumes that farm fuel use is roughly 98% nonroad, while that for the industrial sector is 75-85% nonroad. Thus, the independent users surveys indicates that FOKS is unlikely to be underestimating fuel use in these nonroad equipment sectors.

Summary of Independent User Survey Comparison: Taken together, the independent user surveys do not indicate that our methodology for deriving nonroad fuel demand from FOKS is underestimating nonroad fuel use. The largest difference indicating a possible underestimation is that for commercial building use, 220 million gallons. However, the difference in the construction sector of 100 million gallons would roughly cut this in half. It is likely that the two billion gallon difference in the residential and locomotive sectors combined would more than compensate for the remaining 100 million gallon difference. The nearly identical fuel use estimates by FOKS and the user surveys for the industrial and farm sectors is strong support for the FOKS estimates.

The differences between the FOKS and user surveys for the residential and locomotive sectors are relatively large. One possibility is that somehow fuel is entering the distillate markets covered by FOKS that is not considered when EIA adjusts the FOKS results to total fuel supply. This is investigated in the next section.

Adjusting to Match Distillate Fuel Supply: As described above, EIA adjusts their FOKS fuel consumption estimates so that total no. 1 and no. 2 distillate fuel consumption matches total no. 1 and no. 2 distillate fuel supply per their Petroleum Supply Annual. However, jet fuel is excluded from this reconciliation. The overall difference of 1.6 billion gallons per year shown between FOKS and the user surveys in Table 2-4 above could indicate that more distillate fuel is being consumed than indicated by EIA's Petroleum Supply Annual. For example, some jet fuel could be making its way into the diesel fuel and fuel oil markets, including the highway diesel fuel market. Unlike other high sulfur distillate fuels, jet fuel is not dyed at the refinery. Thus, jet fuel can physically be blended into highway diesel fuel without causing a visible color, indicating the addition of an illegal fuel.

There appear to be two ways that jet fuel could be entering the other distillate markets: 1) via mixing and contamination during shipment, and 2) as a tax evasion strategy. These two possibilities are discussed below.

Mixing During Distribution: One way that jet fuel could enter the distillate market is through contamination via shipment by pipeline. Section 7.1 of the Final RIA presents a detailed description of how fuels are shipped through pipelines. Mixing occurs at the interface between every adjacent batch of fuel. This interface grows in volume as the shipments progress down the pipeline. Usually, the interface is cut into one of the two adjacent batches, usually the one with the least stringent product quality specifications. However, the interface between gasoline and jet fuel or distillate cannot be blended into either batch. This interface is called transmix and shipped to a transmix processor to be separated once again into gasoline and distillate.

Batches of jet fuel can be shipped adjacent to either gasoline or distillate fuel, such as highway diesel fuel or high sulfur distillate. Jet fuel that mixed with gasoline would end up in the distillate fuel produced and sold by transmix processors. This distillate rarely meets jet fuel specifications, so it is usually sold as highway diesel fuel or high sulfur distillate. Thus, this jet fuel which was produced at a refinery ends up in the distillate pool. However, it appears that EIA's Petroleum Supply Annual includes fuel produced by transmix processors, so this "new" distillate fuel produced from processing jet fuel would be included in EIA's total distillate supply and in the adjusted FOKS results.

However, when jet fuel is adjacent to distillate fuel, the interface is usually just cut into the batch of distillate at the end of the pipeline. Thus, this jet fuel also enters the distillate market. However, since it was not ever produced by a refinery, it is unlikely that this new distillate would be accounted for in EIA's total supply of distillate. It would be covered by the FOKS, since it would be sold by a terminal or bulk plant. However, its volume would essentially be removed through the adjustment process.

As discussed in Section 7.1 of the Final RIA, estimates of the volume of jet fuel lost during shipment vary widely, from 1-7%. Assuming that half of this is lost to transmix and half to distillate, this implies that 0.5-3.5% of all jet fuel could be entering the distillate market unaccounted for by EIA's supply estimates. In Table 7.2-7 of the Final RIA, we show jet fuel consumption by PADD in 2001. Excluding fuel consumed in Alaska and Hawaii, which have no pipelines which carry jet fuel, total jet fuel consumption was 20.4 billion gallons. Thus, the volume of this fuel which might be entering the distillate pool unaccounted for is 102-713 million gallons per year. This would explain some, but not all of the 1.6 billion gallon difference seen between the FOKS and user survey estimates. The possibility that this source of distillate fuel is not being accounted for in FOKS should be investigated further.

Tax Evasion: The other possibility is that jet fuel is being consciously shifted to the distillate market during distribution. If this is done prior to the payment of highway fuel excise tax, then this addition is legal. If the shift from jet fuel to diesel fuel occurs after the excise tax has been paid, the addition is illegal. Jet fuel typically commands a slightly higher wholesale price than highway diesel fuel and high sulfur distillate. Therefore, we do not believe that jet fuel is often added to highway diesel fuel or high sulfur distillate legally. However, some blending might occur during temporary shortages of the distillate fuels. Since blending in the other direction is highly unlikely due to produce quality constraints, this possibility should be explored further.

Untaxed jet fuel, however, is much cheaper than taxed highway diesel fuel. Therefore, there is a tremendous economic incentive to blend jet fuel illegally. The potential extent of such illegal blending is not known. The Internal Revenue Service clearly tries hard to ensure that taxes are paid on all fuel used in highway vehicles which are not tax exempt (such as government-owned vehicles and school buses). However, the difference between fuel use from FOKS and the user surveys of roughly 1.6 billion gallons per year represents 4-5% of highway diesel fuel consumption. (This percentage is even less considering that some jet fuel likely gets downgraded to distillate fuel via pipeline contamination, as discussed above.) While it is conceivable that tax cheating could be occurring at this level, this is hopefully not the case. However, the degree that this might be occurring should be pursued further.

Effect of Adjustment in FOKS on Derived Nonroad Fuel Consumption: Another way to evaluate the effect of the adjustment in FOKS to match reported distillate supply is to evaluate the effect of the adjustment on each sector's fuel demand. In 2002, the adjustment process in FOKS reduced total distillate fuel consumption by all sectors except highway vehicles and electric utilities by 1.34 billion gallons. This is twice the upper end of the range of estimated jet fuel volume downgraded to distillate during distribution. This could indicate that some jet fuel is being illegally blended into highway diesel fuel, or could be due to some other unknown factor. If we apply the "nonroad" factors presented in Table

2-4 above to the adjustments, we find that the adjustment process reduced nonroad fuel consumption as derived from the FOKS results by 509 million gallons per year. This is 20% of the 2.4 billion gallon difference in 2002 between the NONROAD and FOKS-derived estimates. Thus, the adjustment process within FOKS appears to have a signficant impact on estimated fuel consumption within the various sectors and derived nonroad fuel use. However, most of the adjustment occurs in sectors not believed to represent nonroad fuel use.

Extension of NONROAD Methodology to Stationary Source Diesel Engines

One additional evaluation of the NONROAD model estimates of fuel consumption can be made. The methodology used to develop the Draft NONROAD2004 model can be easily applied to stationary source diesel engines, which EPA does not include in its nonroad diesel emission inventory. The PSR sales data for several equipment types (e.g., generator sets, air compressors, pumps, welders, etc.) include equipment believed to be classified as stationary, as well as some that is mobile. PSR does not attempt to differentiate between mobile versus stationary, but EPA believes that most of the smaller equipment in these equipment categories is mobile (e.g., those with <175 hp engines), while larger equipment is mostly stationary. NONROAD excludes the assumed stationary source equipment sales and population from its calculations, but PSR's estimates for the annual activity for these equipment include both stationary and mobile equipment. Thus, EPA's estimates for load factor and useful life should also apply equally well to both stationary and mobile applications of these particular equipment types.

Table 2-5 presents those inputs from Draft NONROAD2004 for generator sets which vary by horsepower category. All generator sets are estimated to be used 338 hours per year at an average load of 43%. As indicated above, nonroad engines below 100 hp are estimated to have a brake specific fuel consumption of 0.408 lb/hour, while large engines consume 0.367 lb/hour.

Table 2-5
Draft NONROAD2004 Selected Inputs for Generator Sets

HP Bin	Total Population 2000	Mobile Percentage	Annual Growth	Average HP
<6	23,785	90%	5.4%	5.4
6-11	94,304	90%	3.6%	8.4
11-16	45,746	90%	1.9%	13.6
16-25	76,863	90%	4.2%	21.3
25-40	67,603	90%	1.7%	33.4
40-50	35,729	70%	3.2%	45.2
50-75	96,210	70%	1.8%	60.0
75-100	172,077	70%	2.5%	86.4
100-175	183,930	20%	1.1%	135.7
175-300	145,475	15%	1.9%	238.0
300-600	113,819	10%	0.3%	419.3
600-750	26,003	0%	0.6%	682.1
750-1000	31,455	0%	2.5%	887.1
1000-1500	27,888	0%	2.4%	1247.9
1500-2000	11,553	0%	4.9%	1732.0
>2000	3,359	0%	3.5%	2400.8

Starting with the base year population (in 2000) for each horsepower category, we subtracted those assumed to be in the mobile category, grew the population for two years (linearly, in Draft NONROAD2004), multiplied the resulting projection by the annual activity per piece of equipment, the average load factor, the average horsepower and the applicable brake specific fuel consumption. The result is an estimate of total fuel consumption by stationary equipment in each horsepower category. These were summed across all the horsepower categories to produce a total fuel consumption estimate for all stationary generator sets. This methodology was then repeated for air compressors, pumps, welders, irrigation pumps, gas compressors and hydraulic power units, all of which are assumed to have similar splits between mobile and stationary uses. The result was a fuel consumption by stationary equipment for the year 2002 of 5.17 billion gallons per year.

These equipment would likely fall under a variety of EIA FOKS sectors, primarily industrial, commercial, electric utility, and oil company. Of the total fuel use in these four sectors, this stationary diesel equipment fuel use would not include fuel that we assumed above that was used for nonroad equipment (by definition), building and water heating (included in commercial), and on-highway vehicle use (highway use category plus some in commercial). It is possible to obtain a more robust evaluation of the potential accuracy of the NONROAD methodology by adding those sources which clearly do not include any power equipment (either mobile or stationary) to the NONROAD estimates for all power equipment (mobile and stationary) and comparing the sum to the total amount of distillate supplied to the U.S.

We took the estimate of fuel use by nonroad equipment directly from the NONROAD model. We then applied the NONROAD methodology to diesel equipment which the EPA assumes is non-mobile (stationary) in the NONROAD model to estimate fuel use by this equipment. Fuel use in the residential, marine, and highway sectors were assumed to include no fuel used in either mobile or stationary diesel equipment. We obtained estimates of fuel use for these categories directly from FOKS. We assumed that 99% of fuel used in the locomotive sector was not fuel used in any of the mobile or stationary diesel equipment covered by the NONROAD model. Total locomotive fuel use was taken from both FOKS and AAR (a range was used). Finally, we added fuel use from the commercial sector which would not include any fuel used by stationary or mobile diesel equipment. We assumed that this would include fuel used in commercial buildings and by highway vehicles exempt from the highway fuel excise tax. Fuel used in commercial buildings was assumed to be all No.2 fuel oil in the FOKS commercial sector (consistent with our FOKS-based methodology above) and from the EIA commercial building fuel use survey. Fuel used by tax exempt highway vehicles was taken from DOT. We assumed that all fuel used in the FOKS categories of industrial, military, oil industry and electric company could be either mobile or stationary diesel equipment included in the NONROAD model or the stationary versions of equipment included in the NONROAD model. This assumption is likely to under-estimate total distillate fuel consumption, as it is highly unlikely that 100% of all of these categories fuel use is in such equipment. However, absent any independent information to the contrary, we believed that this approach was the most appropriate. It effectively minimizes total distillate fuel consumption from these sectors and allows for the highest practical level of fuel consumption from stationary generator sets. Thus, should the application of the NONROAD methodology to stationary generator sets lead to a higher prediction of overall distillate fuel use than indicated by EIA fuel supply statistics, this would be a strong indication that the NONROAD methodology for generator sets was over-predicting in-use fuel consumption.

Total distillate supply was taken from EIA's Petroleum Supply Annual. This EIA report is based on 12 months of reporting by every U.S. refiner, as well as every importer. Thus, it is not a survey, per se, but a mandated reporting of production, exports and imports. It is expected to be much more accurate than any of the sector specific estimates of fuel consumption.

These distillate fuel consumptions and total supply are shown in Table 2-6.

Table 2-6
Distillate Demand With Draft NONROAD2004 Extended to Stationary Sources: 1999

Sector	Distillate Usage (Billion gallons/year)
Mobile Land-Based Nonroad Equipment (Draft NONROAD2004)	10.05
Stationary Equipment (Draft NONROAD2004 Methodology)*	5.05
Residential Heating (FOKS residential sector and EIA Residential Fuel Use Survey)	5.82-7.72
Commercial: Building Heating (FOKS No. 2 fuel oil use from commercial sector and EIA Commercial Building Fuel Use Survey)	1.30-1.52
Commercial: School buses and public fleets (DOT)	1.00
Locomotive (FOKS locomotive sector and AAR)	2.75-3.86
Marine Vessel (marine sector from FOKS)	2.05
Highway (FOKS highway sector)	32.06
Total Demand	60.08-63.31
Total Distillate Supply (EIA PSA)	54.76

* NONROAD does not normally produce estimates for stationary equipment. To obtain such estimates one must feed the model stationary equipment populations instead of the normal mobile equipment populations

Table 2-6 shows that the application of the NONROAD methodology to both mobile and stationary source diesel powered equipment results in an over-prediction of fuel consumption relative to total distillate supply per EIA of 5.35-8.37 billion gallons per year. This is much greater than the difference between the Draft NONROAD2004 and FOKS estimates of land-based nonroad equipment in 1999, which was 2.39 billion gallons per year. The reason is that the Draft NONROAD2004 estimate of fuel demand by stationary power equipment is greater than that implied within FOKS. Again, these equipment would necessarily fall under five EIA FOKS sectors, industrial, commercial, electric utility, military and oil industry. The total amount of fuel used in these five sectors, as estimated by EIA FOKS 1999, is 7.03 billion gallons per year. However, 2.57 billion gallons of this total were allocated to nonroad equipment according to the methodology outlined in Chapter 7 of the Final RIA. This leaves 4.43 billion gallons per year. However, the commercial sector also includes low sulfur diesel fuel consumed in selected highway vehicles, namely school buses and public (federal, state and local) fleets, which do not pay highway fuel excise tax. Per estimates from the Department of Transportation, these fleets consumed 1.00 billion gallons per year.[12] Finally, as discussed above, roughly 1.30-1.52 billion gallons per year is used in commercial buildings. While some of this might be occasional use by back-up generators, it is unlikely that this use is a sizeable fraction of total building use. This is supported by the fact that the EIA commercial building survey shows that most distillate fuel use is in buildings for which distillate fuel is the primary fuel used for heating and cooling (i.e., no use of natural gas). Thus, the maximum FOKS-based total for stationary diesel fuel consumption is roughly 1.90- 2.12 billion gallons

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[12] EIA FOKS for 1999 estimates that 0.93 billion gallons of low sulfur diesel fuel was consumed by the commercial sector. Per our methodology outlined in Chapter 7 of the Final RIA, we assume that this fuel is used in school buses and public fleets. The fact that the DOT and EIA FOKS estimates are within 7% confirms this assumption quite well.

per year, versus the 5.05 billion gallon per year estimate generated by extending the Draft NONROAD2004 methodology to stationary diesel equipment. Thus, extending the NONROAD methodology to stationary diesels increases the difference between "NONROAD" and FOKS by an additional 2.93-3.15 billion gallons per year. The FOKS estimates for non-diesel fuel consumption, namely residential and commercial building heating, railroad and marine vessel fueling, are, if anything, lower than those from the independent surveys. Thus, it appears likely that some aspect of the NONROAD methodology for generator sets is leading to overly high projections of fuel consumption.

Summary

The difficulty in using the other estimates of fuel consumption (FOKS, Census, AAR, etc.) to adjust NONROAD fuel consumption estimates is that the source of the difference in estimates is unknown. An across-the-board adjustment might be adjusting the fuel consumption of an equipment type whose fuel consumption is not being over-estimated. Or, both new and old equipment's fuel consumption could be adjusted to the same degree, but the difference could in fact be due primarily to one term or the other. Thus, rather than build such an adjustment into the NONROAD model, we have decided that it is more prudent to leave the model as is and continue to use it as our primary estimate of NONROAD fuel demand and emissions. However, to ensure that a potential error in the model's outputs are not leading to an inappropriate decision regarding the additional control of nonroad emissions and fuel quality, we conducted a sensitivity analysis using fuel consumption estimates derived from the FOKS results, as described. We reiterate that in this sensitivity analysis (see Appendix A of Chapter 8 of the Final RIA), the fuel consumption from the NONROAD model at the national level was adjusted to match that of FOKS on an annual basis. The emissions projections from NONROAD were adjusted by the same annual factor. In this way, we have considered the available data relating to NONROAD fuel demand and emissions and have concluded that the variations in available data are not so large as to affect the rulemaking outcome.

2.3.2.2.3 Future Growth

What Commenters Said:

The comments in this section can be summed up as follows-

> *The NONROAD model overestimates the future growth in emissions from land-based nonroad equipment and, thus, emission reductions due to the proposed rule. Adjusting NONROAD fuel consumption (and thus, emissions) to match the growth projected by EIA's 2002 Annual Energy Outlook (AEO 2002) [or now 2003] would produce more accurate estimates of emissions and associated emissions benefits.*

DDC and EMA commented that the model significantly overestimates growth in diesel use and the methodology used to develop the NONROAD growth rate appears to be technically unsound. The growth projections used in NONROAD 2002A have been carried over from previously versions of NONROAD, even though EPA has found that the Power Systems Research (PSR) data used as the basis are flawed. There are several alternatives from which growth projections can be obtained, the most relevant being diesel fuel consumption projections, which offer a more robust analysis of future off-highway diesel use. The growth rates from NONROAD appear to be overstated by a factor of three as compared to EIA data, and by 2010 the diesel fuel consumption estimates are more than 50 percent greater than those of EIA. The model consistently overestimates growth rates, thus overstating the activity and emissions from diesel nonroad equipment. EMA also provided a table comparing the EIA-based growth rates to the NONROAD rates within each type of nonroad application to support their assertion that the growth rates are overestimated across all applications.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 8
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 93-95

EMA further commented that separate growth projections are applied by fuel type, but the model contains only national average growth rates. No regional variation is accounted for in the model. In addition, the 7-year window of the PSR data used by EPA is not sufficiently long enough to be considered representative of more general national growth trends. Lastly, EMA noted that projecting the linear growth rates unchecked to 2050 without considering changes to demographics and economic sectors is technically unsound.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 94-96

EMA commented that EPA is using their own evaluation of PSR sales data to derive the current model's 1998 base year population data, but is using unadjusted PSR population data for growth projections. This inconsistency is inappropriate and unreasonable. PSR population estimates are derived and are not directly measured and have not undergone adequate peer review, as the data are considered to be proprietary. EPA believes that the PSR population data are flawed, yet continues to use these data as the basis for growth projections in NONROAD. EMA provided additional discussion on this issue and concludes that this cannot be a reasoned basis for the rule.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 95-96

EMA commented that the growth factors analysis has not been updated in five years and does not reflect more recent data now available from both PSR and alternative sources or recent economic trends. Growth projections were derived from data from the PSR PartsLink database, which is based on diesel engine population estimates between 1989 and 1996 and EPA has not updated their original analysis of NONROAD growth projections since 1998.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 95-96

EMA commented that EPA overestimates the growth estimates in the NONROAD model, thus overstating the need and justification for the proposed Tier 4 standards. The EIA-based growth rates were incorporated into the NONROAD model to determine the net change in the national, land-based diesel off-highway inventory for NO_x and PM (not including the effects of the proposed rule). This analysis was completed by running the NONROAD model for each year from 1998 to 2030 and by converting the modeled emissions and fuel consumption into a mass per unit fuel consumed variable. The fuel consumption increase from 1998 was assumed to equal 1.1 percent as derived from EIA resources. The modified inventory was then estimated by multiplying the mass per unit fuel consumed times the 1.1 percent growth rate in fuel consumption. By updating the growth data, NO_x and PM inventories decreased by 17 and 22 percent in 2010 and 2015, respectively, which is a critical planning period for the upcoming 8-hour ozone and fine PM air quality plans. The commenter provided additional discussion regarding the results of their analysis, including figures that show PM and NO_x emission trends in the context of the revised growth rates. EMA concluded that this analysis supports their assertion that EPA has overstated the need and justification for the proposed Tier 4 standards.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 99-101

AEM commented that EPA overestimates the emissions inventory growth estimates in the NONROAD model. EPA should use its data representing fuel usage by segment as the best indicator of nonroad equipment usage. Data for farm and off-highway fuel sales are flat from 1984 to 2002, which indicates that the emissions contribution from these engines cannot be increasing at the rate EPA is projecting in its emissions inventory analysis.

Letters:
Association of Equipment Manufacturers, OAR-2003-0012-0669, 0670 p. 11-12

API and Marathon commented that it is not possible to predict an accurate emissions inventory 27 years into the future, regardless of whether it is based upon a simple extrapolation of 7 years of recent equipment population history or projections of economic indicators. EPA's estimates should account for the uncertainties in the estimated emissions benefits that are based on these predictions (see additional discussion under Issue 2.4).

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 43
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 39

API and Marathon commented that there are two factors that contribute to the relatively large future growth in total activity estimated by the NONROAD model. These are the assumptions that equipment hours of use per year and load factor are a function of equipment type and do not vary with age. These assumptions run counter to numerous motor vehicle-related studies in the literature that have demonstrated that consumers tend to use older vehicles less intensively than newer ones. This pattern of use would also be characteristic of nonroad engines.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 43-44
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 39-40

API and Marathon commented that EPA relies on the extrapolation of historical trends in population size in order to project the emissions inventories and benefits associated with nonroad land-based diesel engines using its draft NONROAD2002 model. However, for the railroad locomotive equipment sector, EPA developed estimates of emissions inventories and proposal benefits based on fuel consumption projections and growth rates drawn from Table 7 of the EIA Annual Energy Outlook 2002. It is inconsistent for EPA to reject the use of economic indicators for growing the population of one segment of the nonroad diesel engines while endorsing and applying this method for another segment.

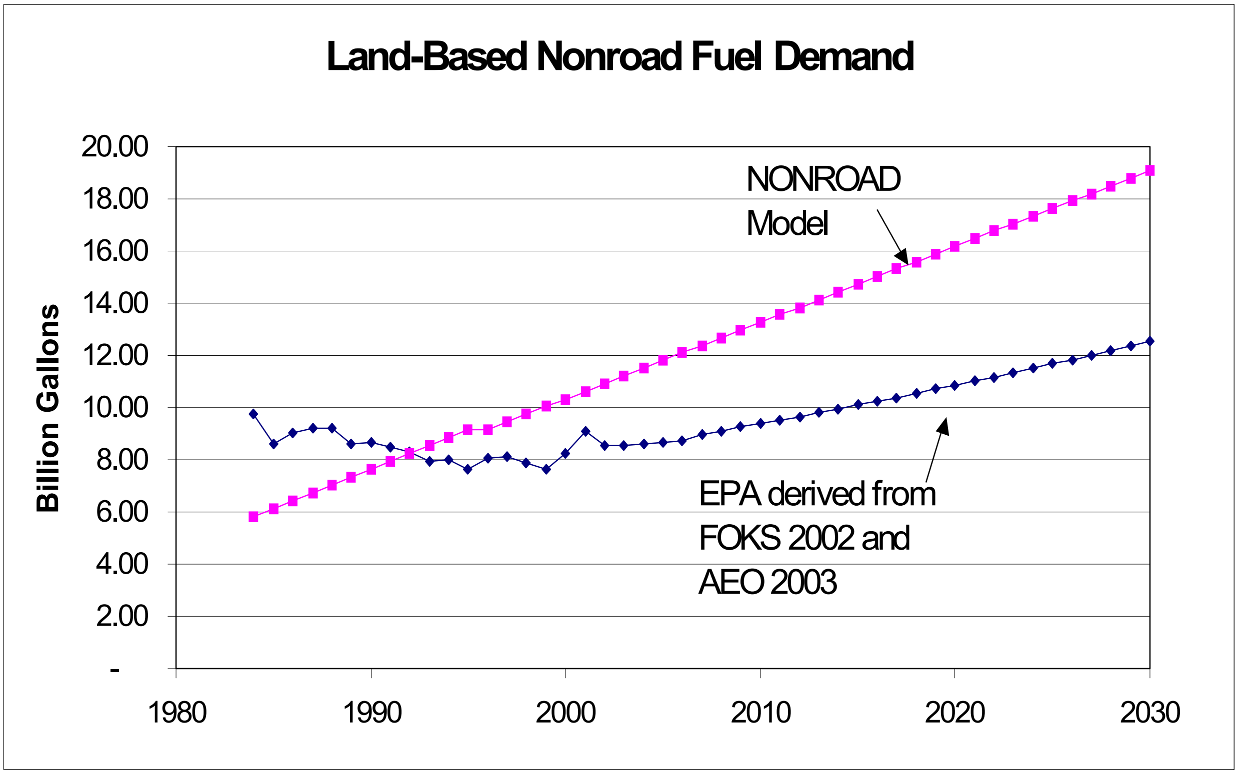
Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 45
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 41

Our Response:

In summary, the projected growth in nonroad fuel consumption based on projections in EIA's Annual Energy Outlook (AEO) 2003 report and the EPA NONROAD emissions model differ substantially. Growth based on AEO 2003 is 1% per year (from year 2000 levels), while that for the NONROAD model is 3% per year (from 2000 levels). Any future growth rate is uncertain to some degree. However, the historic trend in estimated nonroad fuel consumption based on FOKS from 1984-2002 indicate less than 1% per year growth. While uncertainties exist in the FOKS estimates and our methodology to convert the survey results to nonroad fuel consumption estimates, it is not clear why these discrepanices would change significantly over time. At the same time, we recalculated the growth in nonroad equipment populations in NONROAD using additional sales data, as well as segregating sales and population growth by horsepower type. This process led to an increase in the projected growth in equipment population and thus, fuel consumption. Thus, the reasons for the difference in the projected growth in nonroad fuel demand between AEO 2003 and NONROAD remain unclear. Because of this, we are continuing to base future growth on the growth in nonroad equipment population as incorporated in the NONROAD emissions model. However, as a cross-check, as noted above, we have conducted a sensitivity analysis (see Appendix A of Chapter 8 of the Final RIA), to look at the effect of estimating the costs, emission reductions and cost effectiveness for the final rule program assuming future growth in nonroad fuel consumption based on AEO 2003. The results of this sensitivity analysis are summarized at the beginning of the Section 2.3.2.2.2 above.

Figure 2-2 shows both Draft NONROAD2004 and FOKS-based fuel demand for land-based nonroad equipment from 1984 through 2030. EIA growth rates were taken from the Annual Energy Outlook 2003.

Figure 2-2



As can be seen, the Draft NONROAD2004 model projects a much higher growth rate (roughly 3% per year, linear relative to 1998) than EIA (roughly 1% per year). No one can predict future growth with absolute accuracy, given the uncertain nature of future economic growth. However, one indication of the reasonableness of any future prediction is its consistency with the past. The methodology used by NONROAD produces the same growth rate in the past as in the future. EIA FOKS estimates, however, show essentially no growth in nonroad fuel demand since the mid-1980's and slow growth over the past decade . EIA's projection of future growth is consistent with this slow growth seen in FOKS estimates since 1992 or so. Thus, one important question is whether there is any evidence that one or the other estimate of historical growth is more accurate.

Growth in total equipment activity in NONROAD is driven by growth in equipment population. At EPA's request, PSR developed total equipment populations by equipment type for the years 1992-1998. Generally, PSR utilized their own sales database from 1973-1998, as well as estimates of scrappage, to generate these populations. These seven years of equipment population were based on sales by horsepower class, as well as equipment type. Therefore, the population trends should ideally reflect any trends towards smaller or larger equipment occurring during this timeframe. However, in NONROAD, the same growth rate is applied to all equipment in a given category, regardless of horsepower class.

As indicated in Section 2.3.2.2.2, for several inputs, data do not exist to confirm or refute the inputs to the NONROAD model. Therefore, the accuracy of these inputs cannot be assessed. However, in attempting to respond to the comments made on the model and its use in support of the nonroad rule, EPA performed a number of analyses to evaluate the specific growth rates incorporated in Draft NONROAD2002.[13] As historic equipment sales provide one of the primary inputs into the projection of future equipment populations, for these analyses, we updated the historical sales data that is used to generate the base year equipment populations. Specifically, EPA requested updated equipment sales data from PSR for 1999 and 2000. We also requested that PSR review and update its sales estimates for previous years to better account for imports and exports. These expanded and updated sales estimates were used in our assessment of future growth as projected in the NONROAD model.

Finally, EPA evaluated whether applying the same growth rate for all equipment by type, regardless of horsepower, might be introducing a bias in the growth rates. We were particularly interested in the possibility that the growth in sales of smaller equipment was outpacing that of larger equipment, this would lead to an over-estimation of the growth in fuel consumption, since larger equipment use more fuel per hour than smaller equipment. This could conceivably occur as diesel engines penetrated the market for smaller equipment.

EPA therefore prepared sales growth rates for a number of equipment types by horsepower category and evaluated whether these horsepower-specific growth rates produced a different growth in fuel consumption than the more typical growth rates based just on equipment type. In fact, the horsepower-specific growth rates increased the projected growth in fuel consumption, as opposed to lowering it. Given the already large discrepancies between NONROAD results and AEO-based results discussed above, we decided not to incorporate these horsepower-specific growth rates at this time, though we do note that they raise the possibility that NONROAD results are conservative. It may be more feasible to incorporate higher sales growth in to NONROAD in the future once we are able to confirm or improve other aspects of the model, such as scrappage, annual activity, load factor, etc.

Regarding the growth in fuel demand resulting from the FOKS performed over time, the survey has essentially been applied in a consistent manner since 1984. We are not aware of any reason why a potential bias in the survey would change over time. Looking at the fuel consumed in the various sectors tracked by EIA FOKS, only the highway and off-highway (construction and other) sectors grew substantially from 1992 to 2002 (61% and 28%, respectively). Military use was the only sector to shrink substantially, while use by electric utilities varied widely, but without a distinct temporal trend. The remaining sectors showed little net change (e.g., less than 10% over the 10 year period). Thus, the significant growth indicated by NONROAD (37% between 1992 and 2002) is only exceeded by the FOKS highway sector. FOKS off-highway shows about three-fourths of the NONROAD growth. Assuming that any bias in the FOKS estimates is consistent over time, the only way that the NONROAD and FOKS historic growth rates can be reconciled would be for an increasing volume of taxed, low sulfur diesel fuel to be used in nonroad equipment without a tax refund being requested. The volume of taxed, highway fuel used in nonroad equipment when the user does not request a tax refund is certainly not well known. However, why this volume would increase between 1992 and 2002 is not clear. Also, the degree of increase would need to be substantial to explain the growth projected by NONROAD. NONROAD projects an increase in nonroad fuel usage of 3.0 billion gallons between 1992 and 2002. Using FOKS, this increase is only 0.25 billion gallons. The difference of 2.75 billion gallons represents more than a third of total nonroad fuel usage in 1992 per NONROAD or FOKS. Thus, essentially all of the growth in

[13] NONROAD Emissions Modeling Team, "Growth Analyses for Nonroad Diesel Modeling", EPA memorandum, April, 2004.

nonroad equipment fuel usage between 1992 and 2002, equal to a third of total nonroad equipment fuel usage in 1992, would have to be by users who did not take the effort to obtain a tax credit equal to roughly 40 cents/gal.

Of course, the other explanation is that there is a trend in some bias within FOKS that is masking a significant increase in nonroad fuel use. While the confirmation of the FOKS estimates by AAR and Census surveys in 1999 was described above, comparisons of earlier FOKS estimates with earlier user surveys show similar results. Thus, any trend in a bias within FOKS would have to be in a sector not addressed by user surveys, such a the military or marine sections. The volume of nonroad fuel within these sectors is much smaller than the volume needed to explain the difference in growth, however. Thus, substantial questions exist about the substantial growth prior to 2002 projected by NONROAD.

The primary reason for NONROAD's projected growth is an increase in equipment sales over time. As mentioned above, this increase in sales also appears to be accompanied by a small increase in average horsepower and/or annual activity, so that the growth in total horsepower-hours per year by nonroad equipment increases at a slightly greater rate than simply number of in-use nonroad equipment. While there may be some uncertainty in the PSR sales estimates, we have no reason to believe that there is a substantial bias which is changing over time. In other words, we have no reason to doubt that nonroad sales are increasing. Given the assumptions built into NONROAD (constant equipment life, scrappage rates, annual activity, horsepower, engine efficiency, load factor, etc.), this sales trend translates fairly directly into increased fuel usage. Thus, the only explanation for increasing equipment sales and constant fuel usage is that one or more of the above factors are changing over time. For example, nonroad equipment could be scrapped at a faster rate due to earlier onset of obsolescence. Or, rather than being scrapped, this older equipment is simply being stored and not used as often as older equipment in the past. Or, as diesel engines have penetrated new equipment markets, or nonroad equipment has taken on new uses, the load factors, annual activities, etc. have dropped, causing the rate of increase in fuel usage to be much lower than that of sales. Due to a lack of information quantifying, or even pointing to, any such trends, NONROAD assumes that most aspects of nonroad equipment usage and life remain constant over time.

Finally, it should be mentioned that there is significant uncertainty in the sales growth rate of farm equipment. There was a significant spike of farm equipment sales in the mid 1970's related to increased grain exports to the Soviet Union. When these exports ended, sales of farm equipment dropped precipitously. We considered two approaches to accommodating this spike in sales: 1) include them, and 2) exclude them. The first approach yielded essentially zero growth in projected farm equipment sales. We believed that this would be inappropriate for a projection scenario stretching over several decades long past the 1970's anomaly. Excluding the sales spike yielded a growth rate close to 3% per year for farm equipment sales, which we believed to be more appropriate.

However, a third approach to addressing the spike can be considered, which is not reflected in our numerical analyses based on approach (2) above, namely, to assume that the imposition of the grain embargo led to depressed sales in new agricultural equipment during the early 1980's. This view would interpret the spike in sales as uncharacteristically high and the depressed sales immediately following the spike as uncharacteristically low. This third approach would lower the historic "base trend" from which growth is projected relative to the first approach described above, but would raise this base relative to the second approach. Thus, it would have likely resulted in a positive rate of growth in farm equipment sales, but less than the 3% currently projected. As farm equipment represents a quarter of the fuel consumption by nonroad equipment in Draft NONROAD2004, any significant reduction in farm growth would have a significant impact on total growth. Taking this approach to assessing farm sales growth would likely bring the Draft NONROAD2004 and EIA FOKS estimates of historic growth closer, but it is unlikely that they would match. Thus, some other factor(s) appear to be causing significant differences between equipment sales growth and fuel usage growth.

EIA projects future growth in fuel demand by economic sector in the *Annual Energy Outlook* reports (AEO). Applying the AEO 2003 growth rates to the baseline year 2002 estimate of fuel use by land-based nonroad equipment using FOKS, nonroad fuel growth would average just under 1% per year from 2000-2025 on a linear basis relative to 2000. The comparable NONROAD projection is 2.2% growth per year over the period 2000-2025. Both projected growth rates are larger than the historic growth rate per FOKS, which is essentially flat. Of the two future projections, the AEO 2003 projection is closer to the historic rate. Again, the cause of Draft NONROAD2004's higher growth rate is unclear and what types of equipment might have a lower growth rate are unknown. Thus, we decided not to try to adjust the aggregate Draft NONROAD2004 growth rate to match that of AEO 2003, but will continue to evaluate the issue of nonroad equipment growth in the future. However, as we evaluate the sensitivity of our decisions regarding Tier 4 nonroad emission and fuel quality standards to the use of FOKS nonroad fuel estimates, we will do the same with the use of AEO 2003 growth rates.

We will continue to evaluate the estimation of growth in the use of nonroad equipment in the future. Based on our updated assessment of historic equipment sales, sales of some important equipment types are growing at a fairly high rate. In contrast, the EIA FOKS surveys indicate that fuel use is growing much more slowly. Why, based on available data sources, fuel use is not growing at the same rate as sales is not clear. A trend towards a smaller nonroad engine fleet does not appear to be the reason for the difference. There may be differences in fuel use trends within the larger FOKS sectors which affect nonroad fuel use relative to heating oil. Some of the assumptions contained in the NONROAD methodology, such as equipment life (in hours) being solely a function of engine horsepower, constant annual activity over the entire useful life, etc., may be affecting the projected growth in fuel use. As EPA incorporates nonroad emissions into the Motor Vehicle Emissions Simulator (MOVES) model, we hope to resolve these issues to improve our confidence in current and future projections of nonroad emissions. Nevertheless, as discussed above, we do believe the our nonroad diesel rulemaking makes use of the best data available to us for projecting growth at this time.

2.3.2.3 Transient Adjustment Factors

What Commenters Said:

API and Marathon commented that the uncertainty associated with the use of TAFs in the NONROAD model should be quantified. The transient adjustment factors (TAFs) were developed from a very limited dataset of tests on nonroad engines. The commenters stated the belief that EPA arbitrarily increased the Tier 2 TAFs for NO_x and PM by 10 percent and 20 percent respectively, citing the lack of sufficient test data and applied the TAFs to the Tier 3 steady-state emission factors in the model. The TAFs for PM range from 1.00 to 2.37 while those for NO_x range from 0.95 to 1.21. Lastly, the commenters stated that EPA has not fully documented the criteria used to assign specific TAFs by nonroad equipment category and the overall net effect of the TAFs is unclear.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 45
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 41

Our Response:

EPA based the TAFs used in the draft NONROAD Model (as well as the parallel use of these factors in the Transient Compliance Adjustment Factors found in section 1039.104 (g)) on the most comprehensive set of data available. These data included nine engines tested on three cycles and three engines tested on seven cycles.

We disagree with characterization of the TAF adjustments for Tier 3 engines as arbitrary. EPA has extensive experience with the technologies manufacturers are likely to use for emission control to comply with the Tier 3 regulations, and our engineering judgement suggests strongly that these technologies will have a different and detrimental impact on transient emissions when compared to Tier 2 technologies. We therefore made an estimate of the potential change in TAFs for Tier 3 based on our engineering judgement. In the future, as Tier 3 engines are produced and certified we may at a later date update the model to reflect the latest information regarding the TAFs for those engines. The application on TAFs to the Tier 3 steady-state emission factor was an oversight. In the revised version of the NONROAD model used in the final rulemaking process (draft NONROAD2004), the TAF adjustment to Tier 3 steady-state emission factors has been removed.

In regard to not fully documenting the criteria used to assign specific TAFs, EPA discussed this in the technical report entitled, Exhaust Emission Factors -- Compression-Ignition, NR-009b (EPA420-P-02-016). This report, as well as others containing documentation for the NONROAD model can be found on the EPA/OTAQ website at http://www.epa.gov/otaq/nonrdmdl.htm. As stated in this report, EPA matched nonroad applications with the test cycle that most closely represents the nonroad activity for a given application. The TAF adjustments have also been peer reviewed, and EPA made some changes to the TAF adjustments based on that review.

In regard to the net effect that the TAFs have, running the NONROAD model without the TAFs shows that NOx emissions are 1 to 3 percent higher out to 2011. After 2011, there is a less than 1 percent difference. For $PM_{2.5}$, the non-TAF-adjusted emissions vary between 20 and 27 percent lower from year to year out to 2015. Beyond 2015, the difference between TAF-adjusted and non-TAF-adjusted emissions decreases down to about 10 percent in 2040 as Tier 4 engines are introduced into the fleet.

2.3.2.4 Deterioration Rates

What Commenters Said:

The Colorado Department of Public Health and Environment commented that deterioration rates should be revised. Colorado further commented that EPA should account for the emissions performance and deterioration exhaust rates of on- and nonroad diesel equipment using a higher sulfur diesel fuel and increases in emissions or the rate of emissions tampering as a result of poor in-use performance.

Letters:

Colorado Department of Public Health and Environment, OAR-2003-0012-0687 p. 2

Our Response:

We agree with the commenter that it is important to account for increases in emissions over the life of the vehicle due to any number of influences including fuel quality, tampering and deterioration. Currently, our nonroad model does account for fuel sulfur levels and the impact of fuel sulfur on direct PM emissions and SOx emissions. We believe the model accurately captures the impact of the fuel sulfur level both on current technology engines and future technology engines.

Similarly, the model does currently include deterioration factors intended to account for both the gradual deterioration inherent in even well maintained engines, and also, the substantial higher deterioration caused by malmaintenance and tampering. These estimates are based on data for on-highway diesel engines that we believe is broadly representative of nonroad diesel engines as well.

Thus, we believe our nonroad engine model already appropriately accounts for the issues raised by the commenter.

2.3.2.5 Engines in the Greater than 750 hp Category

What Commenters Said:

The Union of Concerned Scientists commented that the NONROAD model does not include accurate data for engines in the greater than 750 hp category. Emissions from engines greater than 750 hp may be underrepresented by EPA's NONROAD model, which does not account for any emissions from generator sets. Lastly, UCS commented that the RIA shows that over 5,000 engines over 750 hp are sold every year, and over half of those are generator sets.

<u>Letters:</u>
Union of Concerned Scientists, OAR-2003-0012-0830 p. 6-7

Our Response:

The version of NONROAD being used for this rulemaking, based on information developed in the past, does not account for mobile generator sets over 750 horsepower. Through this rulemaking process, EPA has gathered useful information about the character of the market for mobile generator sets over 750 horsepower, however, we did not feel that sufficient documentable quantitative information was available at this time to warrant making changes to NONROAD. Instead, we performed a sensitivity analysis increasing the fraction of diesel generators sold in the U.S. which are considered “mobile” (and therefore decreased the percentage which are “stationary”) and increasing the annual hours of use for several categories of mobile machines in the >750 horsepower category, for which some indication exist that these too may be underestimated. Results of this sensitivity analysis are presented in Appendix A to Chapter 8 of this RIA. The results of the sensitivity analysis do not change our view as to the standards we are adopting in this rulemaking for greater than 750 hp engines, and indeed helps to confirm our approach to setting standards focused achieving emission reductions from these engines, and especially from large generator sets, as early as possible.

2.3.2.6 Use of NONROAD2002 as a Justification for the Proposed Rule

What Commenters Said:

The New York Department of Environmental Conservation commented that NONROAD2002 is currently the best available tool for the development of nonroad mobile source emissions inventory development, but should not be used to justify the proposed rule since it is still in draft form. New York believes that it is inappropriate to propose a rule of this magnitude based on an air quality modeling tool that is still in draft form. The proposed emissions standards are built into NONROAD2002, which precludes the model's finalization until the proposed standards are finalized. However, EPA has had ample time prior to the proposal to finalize the Nonroad Model in one of its previous versions. EPA has been using a draft version of the Nonroad Model for several years now for its own emissions inventory development (e.g. NEI) so it remains unclear why the model has never been finalized.

Letters:
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 11

Our Response:

We concur that this model is currently the best available tool for estimating nonroad engine emissions. We are confident that NONROAD2002 produces reasonable emission inventory estimates on which the Nonroad Diesel Rule can be based. As part of this rulemaking and previous rulemakings (i.e., the Recreational and Large Spark-Ignition Engine, Heavy-Duty On-Highway Diesel and, Tier 2 Rules), the NONROAD model has been extensively quality assured and many improvements have been made to the model. Peer reviews also have been completed on all the major aspects of the model. Also, our confidence is reflected in the fact that we have issued guidance allowing states to use draft NONROAD2002a for their official State Implementation Plan submittals.

2.3.2.7 Incorporation of Commercial Marine Vessels and Locomotives in Model

What Commenters Said:

The New York Department of Environmental Conservation commented that commercial marine vessels and locomotives should be incorporated into a future version of the Nonroad Model or another software based modeling tool. The commenter further stated that it is extremely difficult to quantify emissions of CMV and LM using the present acceptable methodologies and in many cases, states must rely on data provided by EPA.

Letters:
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 11

Our Response:

We agree with this comment. Our goal is to incorporate commercial marine vessels and locomotives into the Motor Vehicle Emission Simulator (MOVES) model, which is currently under development.

2.3.2.8 SO_x versus SO_2

What Commenters Said:

The New York Department of Environmental Conservation commented that EPA should clarify the difference between SO_x and SO_2 in the context of the proposed rule as compared to that in the present version of NONROAD2002. EPA is very inconsistent with its nomenclature when referring to sulfur oxides or oxides of sulfur. Until now, sulfur oxides have been referred to as SO_x as the environmental and industry norm. However, in this proposed rule EPA refers to sulfur oxides as SO_2. EPA reports emissions of SO_2 based upon modeling performed using NONROAD2002. However, SO_2 is presently not an output of NONROAD2002. SO_x is presently the emissions output in NONROAD2002 when modeling for sulfur oxides. This is confusing because SO_2 has never been a modeling output in any previous draft version of the Nonroad Model. This issue must be addressed since the diesel fuel sulfur reductions contained in this proposal have a direct impact on emissions of either SO_x or SO_2.

Letters:
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 11-12

Our Response:

Sulfur dioxide, or SO_2, belongs to the family of sulfur oxide gases (SOx). EPA has established a National Ambient Air Quality Standard for SO_2. The NONROAD model calculates SO_2 emissions, but refers to the output as SOx. Therefore, although the nomenclature in the proposed rule and the outputs from the NONROAD model differ, they are consistent. For the final rule, the nomenclature in the version of the model being used, draft NONROAD2004, has been changed to SO_2. In any case, the majority (generally 99%) of the SOx emissions are in the form of SO_2 with minimal sulfate emissions.

2.3.2.9 Toxics Emissions Incorporated into Model

What Commenters Said:

The New York Department of Environmental Conservation commented that EPA should include toxics emissions in a future release of the Nonroad Model. At a minimum, the commenter added, emissions factors for the toxics of concern specific to this proposed rule (benzene, formaldehyde, acetaldehyde, 1,3-butadiene, acrolein) should be built into the model to help analyze their impact on the total emissions inventory. The Department does not feel that this would be a difficult task since the present version of the model already speciates VOCs into its more specific categories (exhaust, crankcase, refueling, etc.). Current modeling for toxics is an arduous task. Speciation for toxics must be performed using EPA provided emissions factors after VOC and PM emissions are generated using the Nonroad Model.

Letters:
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 12

Our Response:

We plan to incorporate nonroad toxics emissions into the Motor Vehicle Emission Simulator (MOVES) model, which is currently under development.

2.3.3 Draft RIA Emission Reductions

What Commenters Said:

The Mercatus Center commented that the emission reductions in the RIA may be in error. The RIA appears to rely on implausible NO_x and VOC inventories that might render the model output meaningless for substantive air quality projections. According to the RIA, NO_x emissions will be reduced with and without the proposed rule by 40 and 37 percent, respectively, between 1996 and 2030. However, based on a conservative reading of the actual requirements of proposed rules for just the major NO_x sources, national NO_x emissions will decline by at least 50 percent during the next 20 years even when calculated from the current year as a baseline, rather than the higher 1996 baseline used for the RIA. The commenter provided additional discussion on this issue including a table that displays EPA's 2001 NO_x inventory by source category and a histogram that compares source contributions to the 1996 mobile source NO_x inventory based on EPA's emission models versus "real-world" fuel-based estimates (based on A.J. Kean, R.F. Sawyer and R.A. Harley, "A Fuel-Based Assessment of Off-Road Diesel Engine Emissions." Kean et. al.).

The Mercatus Center also commented that the RIA baseline inventory has total VOC emissions declining just 25 percent between 1996 and 2020, decreasing to 17 percent in 2030, which is likely due to EPA's underestimate of the contribution of gasoline vehicles to the VOC inventory. EPA's inventory has only about 40 percent of VOC coming from gasoline vehicles, which is inconsistent with source apportionment studies that show gasoline vehicles as 50 to 75 percent of anthropogenic VOC emissions, with urban and suburban areas more likely to be at the high end of that range. Tier 2 will reduce total emissions from gasoline vehicles by more than 80 percent during the next 20 years, suggesting that actual VOC reductions will be substantially larger than the RIA forecasts.

Lastly, the Mercatus Center commented that CO emissions, which contribute to ozone formation, are overestimated in EPA's models. For example, MOBILE6 projects fleet-average CO emissions of 11 grams/mile in 2005 and 5 grams/miles in 2025, which is inconsistent with data from I/M programs, tunnels, and remote sensing in several cities indicating that CO emissions ranged from 4 to 6 grams/mile during 1999 to 2002. The discrepancy appears to be much too large to be accounted for by missing cold-start emissions.

Letters:
Mercatus Center, OAR-2003-0012-0627, 0828 p. 35-38

Our Response:

EPA believes that the commenter has not taken into account how the NOx and VOC emission benefits will be offset somewhat by the growth of nonroad diesel equipment population.

Tunnel studies estimate motor vehicle emission rates in highway tunnels within which vehicles operate at a relatively constant speed and load while they are fully warmed up. These operating conditions limit their comparability to MOBILE6 predictions. MOBILE6 accounts for cold-start emissions and transient vehicle speeds that occur in real-world driving. EPA thoroughly evaluated the role of tunnel studies in validating overall emission models. (EPA Report Highway Vehicle Emission Estimates I, June 1992; EPA Report Highway Vehicle Emission Estimates II, May 1995). Also, as EPA's guidance on use of remote sensing (Description and Documentation for Interim Vehicle Clean Screening Utility, EPA 420-P-98-008, May 1998) states, remote sensing gives emissions at a single instant in time and, while they represent emissions at that instant, they may not represent emissions over a composite of driving conditions which consist of cold/hot starts, cruises, idle, acceleration, and deceleration. Also, I/M data are generally obtained on a short-test cycle without all the driving modes (especially cold start) of the full Federal Test Procedure). Thus, on an overall basis, there is no inconsistency between these data and MOBILE6 estimates.

It is also worth noting that nationally, diesel engines are not as large a contributor to ambient CO as are gasoline engines. Furthermore, CO reacts at rates far slower than other VOCs and, for most ozone-related assessments in this rule, NOx emissions play a larger role.

2.3.4 EPA Should Report Emission Reductions as a Percentage of Total Emissions

What Commenters Said:

API and Marathon commented that EPA should report emission reductions as a percentage of total emissions. The commenters stated that currently, EPA reports emission reductions of NO_x, SO_2, VOC, and $PM_{2.5}$ from baseline nonroad diesel engine emissions of these species. These commenters believe that it would be helpful if EPA would report both absolute and percentage reduction of these species from total emissions (including nonroad, highway, stationary and natural emissions), which would provide an indication of the overall effectiveness of the proposed control measures.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 53
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 49

Our Response:

There are many possible ways of reporting and summarizing the results of our analyses and, for the sake of making the rulemaking documents as clear and concise as possible, we decided the approach taken is the most appropriate. We note, however, that there is enough information provided in the tables contained in Chapter 3 of the RIA that the reader can calculate both absolute and percentage reductions of the pollutants from total emissions.

2.4 Other Environmental Effects

2.4.1 Climate Impacts Associated with Diesel Emissions

What Commenters Said:

The Clean Air Task Force commented that EPA should include an assessment of the climate impacts associated with diesel emissions. Climate change impacts are now becoming better understood and recognized as important. Nonroad diesel engines are significant emiters of at least two pollutants associated with climate change; black carbon and ozone-forming NO_x. Light-absorbing carbonaceous particles (black carbon) affect global and regional climate by absorbing sunlight and thus heating the atmosphere. These particles typically represent a significant portion of diesel particulate emissions. In addition, while NO_x is unstable in the atmosphere and has little impact on climate directly, it commonly reacts to form tropospheric ozone, which is a significant contributor to global warming. The commenter also provided estimates of positive climate forcing from these substances and noted that EPA should consider the benefits of reducing climate impacts in the proposed rule.

Letters:
Clean Air Task Force, et. al., OAR-2003-0012-0508 p. 6-7

Our Response:

While we agree that the role of black carbon in climate may be important, we disagree that EPA can estimate climate-associated benefits for the rule since there is no global warming potential yet assigned to black carbon as there are for gases such as carbon dioxide, methane, and nitrous oxide. Various investigators (e.g., Marc Jacobson at Stanford University and James Hansen at NASA) are conducting research in this area. Although additional work is underway to characterize emissions of black carbon and its atmospheric chemistry, current modeling indicates black carbon and associated organic material play a major role in global climate change. Diesel PM emissions consist largely of black carbon and associated organic matter. Thus, a reduction in diesel PM emissions will likely contribute to a reduction of global climate change. The use of particulate traps and oxidation catalysts on diesels may result in the eventual elimination of the black carbon and associated organic matter component of diesel particulate, but more research is needed. (1, 2, 3, 4) Regarding the effect of carbon aerosols on global climate, chapter 4 of the fourth draft PM criteria document states,

> [t]he body of available evidence, ranging from satellite to in situ measurements of aerosol effects on radiation receipts and cloud properties, is strongly indicative of an important role in climate for aerosols. This role, however, is poorly quantified. No significant advances have been made in reducing the uncertainties assigned to forcing estimates provided by the IPCC for aerosol-related forcing, especially for black carbon-containing aerosol. The IPCC characterizes the scientific understanding of greenhouse gas-related forcing as “high” in contrast to that for aerosol, which it describes as ‘low’ to’very low.’

Given the low level of understanding of black carbon’s role in global warming, it is not feasible to estimate the effect of this rule on global climate. Still, the rule’s effects on reducing black carbon could have a positive benefit on global warming but whether there is such overall benefit and certainly its magnitude cannot presently be substantiated. It would also be important to characterize all of the effects of the rule on climate (e.g., tropospheric ozone, fuel economy, etc), and the methods to conduct such an assessment are not available.

– Penner, J.E. et al. 2001. Aerosols, their Direct and Indirect Effects. In: *Climate Change 2001: The Scientific Basis*. J.T. Houghton et al. Eds., Intergovernmental Panel on Climate Change, Cambridge University Press.

– U.S. Climate Change Science Program. 2002. Strategic Plan for the Climate Change Science Program (November Draft).

– Jacobson, M.Z. (2002) Control of fossil-fuel particulate black carbon and organic matter possibly the most effective method of slowing global warming. Journal of Geophysical Res., Vol. 107, No. D19, pp 4410-4431.

– Hansen, J.E. and M. Sato. (2001) Trends of measured climate forcing agents. Publications of the National Academy of Science, Vol. 98, No. 26, pp. 14778-14783.

– Lipson, Charles and Narendra J. Sheth, "Statistical Design and Analysis of Engineering Experiments," McGraw-Hill, New York, 1973, page 36.

3. NONROAD ENGINE STANDARDS

What We Proposed:

The comments in this section correspond to Section III of the NPRM, and therefore are targeted at issues dealing with the proposed nonroad engine standards. A summary of the comments received, as well as our response to those comments are located below. For the full text of comments summarized here, please refer to the public record for this rulemaking.

3.1 Engine Standard Levels, Stringency, and Phase-In

3.1.1 General Comments on Engine Standards

3.1.1.1 Stringency of Standards

3.1.1.1.1 General Support for the Proposed Level of Stringency

What Commenters Said:

The New York Department of Environmental Conservation (NY DEC) and Western States Air Resources Council (WESTAR) commented that the proposed new engine power rating classifications offer a tightening of standards in those classes where technology already exists while allowing flexibility to set tighter standards as new technology becomes available for the smallest engine category; in particular, the standards being proposed for all nonroad diesel engines over 75 horsepower are adequate and appropriate. These commenters believe that engines will be able to use existing on-highway technology to meet the proposed standards, and further, that there may be some redesign of the componentry to make it more durable in a nonroad environment, but the necessary technical development is achievable.

The California Air Resources Board (CARB) and the Manufacturers of Emission Controls Association (MECA) also stated that they believe that the stringency of the standards is appropriate since they are technologically feasible and would provide significant air quality benefits. (See additional discussion on feasibility under Issue 3.2)

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 3
New York Department of Environmental Conservation, OAR-2003-0012-0786) p. 6
Western States Air Resources Council, OAR-2003-0012-0711 p. 2
New York Public Hearing, A-2001-28, IV-D-05 [NY DEC p. 12]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [CARB p. 13, MECA p. 57]

Our Response:

A number of commenters expressed general support for our proposed engine standards 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.

3.1.1.1.2 Equal Stringency for All Engines

What Commenters Said:

A number of commenters (ALA, the Mountaineers, STAPPA/ALAPCO, OTC, SC DHEC, US PIRG, CAC) expressed the belief that the proposed standards should be equally stringent for nonroad engines of all sizes. They commented that these state-of-the-art emission control technologies should be required on engines of all sizes to achieve a 90 to 95 percent reduction in NO_x and PM. The also commented that no special loopholes or exemptions should be created for any categories of nonroad diesel engines, large or small, because they all contribute to the pollution which causes health effects.

The NY DEC further commented that since lower hp engines are subject to much more lenient standards, the proposed rule could potentially encourage equipment manufacturers to use smaller engine sizes that would not result in the desired decreases of emissions. As written, they state, the proposed rule could encourage diesel engine manufacturers to rerate diesel engines from slightly above 25 hp to slightly below 25 hp. This would allow a ten fold increase in PM emissions. They raise the same concern for engines near the 75 hp cut point; stating that a 74 hp engine could be used in place of a 76 hp engine, allowing a ten fold increase in NO_x.

NY DEC also commented that Transportation Refrigeration Units (TRUs) are usually diesel powered and many of the engines powering these units are below 25 hp. TRUs are often running in a continuous mode, keeping the product cool during transportation and waiting to load and unload these products. TRUs are very often used in an urban setting where air quality is a major concern. TRUs should be held to the same standards as larger horsepower engines.

Lastly, NY DEC commented that the proposed regulations may cause a wholesale migration from diesel engines to gasoline engines in the low horsepower range. They state that emission regulations should be consistent for all engines regardless of the fuel used and that the gasoline engine regulations may need to be revisited to achieve this.

<u>Letters:</u>
Mountaineers, OAR-2003-0012-0773 p. 1
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 6
Ozone Transport Commission (IV-D-629) p. N214
Sierra Club of Wisconsin (IV-D-714) p. C122, +1
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 8
STAPPA/ALAPCO (IV-D-604) p. N45
STAPPA/ALAPCO (IV-D-703) p. C36-C37
South Carolina Department of Health & Environmental Control, OAR-2003-0012-0476 p. 1
U.S. Public Interest Research Group, OAR-2003-0012-0780 p. 3
60,833 Public Citizens
930 Public Citizens
Clean Air Council, OAR-2003-0012-0613 p. 2

New York Public Hearing
A-2001-28, IV-D-05 [ALA p. 110; Environmental Defense p. 152; OTC p. 214, STAPPA/ALAPCO p. 45]
Los Angeles Public Hearing
A-2001-28, IV-D-07 [ALA p. 220; Environmental Defense p. 93]
Chicago Public Hearing
A-2001-28, IV-D-06 [ALA-Chicago p. 284; STAPPA/ALAPCO p. 36]

Our Response:

These rules implement statutory provisions which require technology-based standards, not risk-based standards. Section 213 (a)(3) of the Clean Air Act calls for EPA to establish standards that provide for the "greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the engines or vehicles to which such standards apply, giving appropriate consideration to the cost of applying such technology within the period of time available to manufacturers and to noise, energy, and safety factors associated with the application of such technology." Section 213 (a) (4) likewise requires consideration of "technology which the Administrator determines will be available." Thus, unless all engines are technically capable of achieving the same standards, they could not have identical emission standards. We are also required to take costs into consideration in adopting these standards, and again, it is unlikely that all nonroad engines incur identical cost impacts. Because of the large diversity in nonroad diesel engines, complying with these provisions involves examining individual power categories and setting appropriate standards for each category. (The 75 hp cutpoint referred to by the commenter, for example, reasonably reflects a point at which highway engine platforms are less likely to be used for nonroad engines.) This we believe we have done as explained in detail in Section II of the final rule preamble and in Chapter 4 of the RIA. As might be expected, this process quite appropriately results in different numerical standards for some engines compared to others.

Regarding the potential for market migration from diesel to gasoline engines, we analyzed this potential as part of the final rulemaking. See Issue 7.2.4 for details.

3.1.1.1.3 Stringency of NOx Limits

What Commenters Said:

CEMA-CECE commented that the final NOx limit is too stringent. Considering the nonroad operating conditions, the final NO_x limit of 0.4 g/kW-hr is too low in the context of the first implementation of aftertreatment technologies. Given the introduction of transient testing (partially under engine cold conditions), NTE, and the unknown deterioration of technologies over 8,000 operating hours, a 90 percent reduction from Tier 3 levels is unrealistic. EPA should start with a more conservative reduction of 60 to 70 percent in order to provide enough flexibility for the industry to fix the numerous technical problems that will certainly arise.

Euromot commented that we should reassess the stringency of the NO_x standards at a time when experience from the on-highway sector is available. They believe that this reassessment should address the differences between test cycles (FTP vs. NRTC), detailed NTE procedures and OBD requirements, availability of NO_x aftertreatment technologies on an industrial and competitive scale, and the relation to test cycles selected, specifically the NRTC.

Letters:
CEMA-CECE, OAR-2003-0012-0598 p. 5
Euromot (IV-D-489) p. 5

Our Response:

Our basis for stringent NOx standards on the schedule described in this rule is laid out in Section II of the final rule preamble and in Chapter 4 of the RIA. We factored in the conditions discussed by the commenter in assessing the NOx standards' feasibility. We note too that engine manufacturers, through the application of the alternative standards discussed in Section II.A.2.b of the preamble, can effectively create a phase-in of lower efficiency Tier 4 NOx controls for a number of years before the final standards take effect, thus addressing the CEMA-CECE concerns about achieving 90% reductions in the early years of Tier 4. In fact, EMA indicated in its comments that this compliance path is likely for most manufacturers.

We believe that the final program provides sufficient time to gain from the field experience with NOx controls in the highway sector over the latter part of this decade. To wait until this experience is in hand before promulgating standards would delay the NOx benefits by several years, because of the need to provide sufficient lead time for manufacturers. This would also create a large amount of uncertainty for manufacturers, and would offset the timing for NOx control from the timing for PM control, forcing another redesign step.

3.1.1.1.4 Stringency of CO Limits

What Commenters Said:

DDC and EMA commented that the CO limit for nonroad engines is significantly more stringent than for on-highway trucks, which is inconsistent with the premise of the NPRM and the derivative nature of nonroad technologies. The stringency of the CO limit for nonroad engines is likely to impede technology transfers and is inconsistent with the CAA section 213(a), which requires that nonroad engine standards be set generally at levels that are equivalent in stringency to on-highway engine standards. While the numerical limits proposed for CO in Tier 4 are unchanged from the Tier 2 and 3 limits, there are ancillary changes in Tier 4 that cause this limit to be much more stringent. These changes include the proposed NTE limits, the addition of the new transient test cycles, and the inclusion of cold start testing. The proposed limits will complicate development efforts and may limit technology choices. In addition, CO is no longer a major environmental issue and is not significantly related to the operation of nonroad machines. (See related discussion under Issue 3.2.1.4).

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 3
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 26, 111

Our Response:

In response to comments that CO should not be addressed at all in this rule because it is no longer a significant environmental problem, and further, that any standard must be equivalent in stringency to CO standards for highway engines, we note that EPA has already found that nonroad engines contribute to CO concentrations in more than one area that does not meet the CO NAAQS, 59 FR 31306 (June 17, 1994), satisfying the prerequisites for establishing CO standards for these engines under section 213 (a) (3). Moreover, EPA is not obligated to adopt standards for CO identical to those for highway engines. Section 213 (a) (3) requires EPA to first consider standards "equivalent in stringency" to those for highway engines in establishing standards for nonroad engines. EPA has done so for all pollutants regulated under today's rule, as set out in RIA chapter 4.1, which emphasizes how the standards adopted in today's rule related to the standards for highway engines and the use of the technologies on which those highway standards are based.

The commenters also note that we are in effect adopting new CO standards for Tier 4 engines by requiring new certification tests for CO as part of this rule. Our intent in adopting these new certification requirements is not to alter the level of stringency of the standard but rather to ensure robust control of emissions to this standard in use. As shown in RIA chapter 4 and further discussed in Issue 3.2.5, the CO standards remain readily achievable using these tests, and we anticipate that no additional engine adjustments are necessary for the standards to be achievable (so there are no significant associated costs). We also explain there that the CO standards can be achieved without jeopardizing the ability to achieve all of the other engine standards. See also Issue 3.1.4.5 for further discussion.

3.1.1.2 Stationary Diesel Engines

What Commenters Said:

Environmental Defense and the Clean Air Council commented that EPA should close the stationary diesel engine loophole as stationary diesel engines have eluded comprehensive air pollution abatement requirements. Environmental Defense notes that in California alone, there are more than 16,000 stationary diesel engines including both emergency backup generators and prime engines (see CARB, Risk Reduction Plan to Reduce PM Emissions form Diesel-Fueled Engines and Vehicles, Oct. 2000, App. 2, p. 17). Unlike backup generators, which typically operate on a limited basis, primary engines run on a regular basis to supplement or substitute energy from the power grid and have a pollution potency many times that of other engines (see Jim Lents and Juliann Emmons Allison, Can We Have Our Cake and Eat it Too? Creating Distributed Generation Technology to Improve Air Quality, Energy Foundation, Dec. 1, 2000, note 5, 13-18). They provided additional discussion on this issue and cites to the attachment to their letter entitled "Smaller, Closer, Dirtier: Diesel Backup Generators in California" as additional supporting documentation. The Clean Air Council noted that some power companies, such as First Energy of Ohio, are employing a strategy of using dirty, exempted diesel "peaking units" at electrical substations in the areas they control. These commenters believe that EPA should take action to control emissions from these sources.

Letters:
Clean Air Council, OAR-2003-0012-0613 p. 2
Environmental Defense, OAR-2003-0012-0821 p. 13-14

Our Response:

This rulemaking's engine standards are being adopted under the provisions of Clean Air Act Title II, "Emission Standards for Moving Sources". Title II does not grant EPA authority to regulate these stationary engines. They are being addressed under Title I section 112 (d) of the Act, a provision which requires EPA to adopt standards which reduce the emissions of hazardous air pollutants from major sources to a level reflecting the maximum achievable reduction (generally abbreviated as MACT), followed by a determination (under section 112 (f) of the Act) of whether sufficient residual risk from emissions from those sources remains to require further control to reduce that residual risk.

3.1.1.3 Phase-in

What Commenters Said:

Detroit Diesel Corporation (DDC) and the Engine Manufacturers Association (EMA) commented that the averaged phase-in standards should be stated instead in the form of interim average standards. They believe that our proposed phase-in approach, though instructive for explaining how the standards were derived, adds unnecessary complication; and that manufacturers around the world need to be able to readily understand what the rule will require in practice. More specifically, they state, European and Japanese regulatory authorities need to have a clear understanding of the averaged standards so they can harmonize their respective standards with EPA's. The commenters believe that it should be clear in the final rule that the averaged standards do not require the adoption of any type of ABT program. In addition, they believe that outreach efforts are needed to explain that the proposed rule will not require full NO_x aftertreatment at the outset, but rather will allow for set, specific "interim" NO_x levels. Therefore, they state EPA should finalize the Tier 4 rule to contain only the following "average" standards: 2.3 g/kW-hr NO_x + NMHC for engines between 56 and 130 kW (effective as of 1/1/2012), 3.3 g/kW-hr NO_x + NMHC for engines between 130 and 560 kW (effective as of 1/1/2011), and 3.5 g/kW-hr NO_x + NMHC for engines greater than 560 kW (effective as of 1/1/2011). Lastly, they stated that we should finalize the "phase-out/phase-in" program only in terms of these interim averaged NO_x + NMHC standards.

Ingersoll-Rand commented that we should modify the proposed phase-in to aftertreatment-based standards for NO_x to account for the difference between highway and nonroad applications. They argue that the establishment of a NO_x phase-in period creates the opportunity for a distinct competitive advantage to vertically-integrated manufacturers. Under the phase-in beginning in 2011, an engine manufacturer must produce at least one phase-in engine for each phase-out engine, but it is likely that the former will be significantly more expensive to produce than the latter. Therefore, manufacturers could gain an economic advantage by keeping phase-out engines for its own equipment, while attempting to sell phase-in engines to equipment manufacturers who are not vertically integrated. Ingersoll-Rand believes that, to resolve these issues, we should set an interim NO_x standard that takes effect at a 100 percent level, without a phase-in, at the beginning of the proposed phase-in period, and that is more stringent than the Tier 3 standard but does not require installation of NO_x aftertreatment.

The IBT commented that the phase-in period is adequate to address economic and fuel supply concerns. Further, IBT stated that the length of the phase-in period is sufficient to reduce undue economic hardship on employers.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 3
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 26, 111
Ingersoll-Rand, OAR-2003-0012-0504 p. 12
International Brotherhood of Teamsters, OAR-2003-0012-0664 p. 2

Our Response:

As discussed in Section II.A.2.c of the preamble to the final rule, we are adopting an option in the final regulations that will allow engine manufacturers to certify all engines in power categories that have a percentage phase-in to alternative NOx standards, instead of the certifying some as phase-in engines and some as phase-out engines. However, we disagree that these alternative standards should be the only option, replacing the phase-in, or that the phase-in approach should in some other way be de-emphasized. Clearly, providing both options will help to maintain consistency with the highway program (which has very similar options) from which NOx control technology will migrate. We also are convinced that the implementation of these standards is still too far off to expect that every manufacturer can have a firm compliance plan in place today, even if they currently expect that only the alternative standards path is likely to be used. We believe, based on discussions with manufacturers and with officials in other standards-setting bodies, that our approach involving two compliance paths is readily understandable and creates no great confusion. The early phase-in of engines meeting the final 0.30 g/bhp-hr NOx standard will benefit the Tier 4 program by providing early experience with them, and so it is important to establish a compliance path and incentives program that encourages them, as we are doing in the final rule.

We do not think that integrated manufacturers will keep phase-out engines for themselves and force other equipment makers to use the phase-in engines. An engine manufacturer that chose such a path would be taking a significant business risk. It would be dependent on the other equipment makers to purchase the phase-in engines so that it could produce an equal number of phase-out engines. If its sales of phase-out engines fell short, it would face either a stop in its production of phase-out engines or large non-compliance fines. Thus, such a business plan is unlikely. We note that our nonroad engine program has created other provisions of this type that allow an engine manufacturer to concurrently build engines with different emissions levels and therefore at different costs (the transition flexibility provisions for equipment manufacturers, for example), and we are not aware that this has led to problems of this sort.

3.1.1.4 Implementation Timeline

3.1.1.4.1 The Timeline Should Be Accelerated

What Commenters Said:

The commenters provided general discussion on the health benefits of an accelerated schedule.

Letters:
Illinois Lieutenant Governor Pat Quinn, OAR-2003-0012-0781 p. 6
New York Public Hearing
A-2001-28, IV-D-05 [NY DEC p. 15; STAPPA/ALAPCO p. 45]

Los Angeles Public Hearing, A-2001-28, IV-D-07 [ALA p. 174]
55,216 Public Citizens
89 Public Citizens

EPA should require the implementation of all standards by 2012. This approach is feasible and affordable. Many of the technologies that will be used to reduce diesel emissions from highway sources can be modified for use in the nonroad sector by 2012. Meeting the proposed standards by 2012 is feasible since many of the engine families will be able to adapt highway-based emission controls to the nonroad sector and since low sulfur diesel will be required by 2010, there is no fuel impediments to full implementation by 2012. One commenter (NRDC) provided additional discussion on this issue, cites to the progress that has already been made in developing control technologies for the highway sector as summarized in the Clean Diesel Independent Review Panel's October 2002 report, and asserts that the progress made to date shows how the certainty of a final regulation can provide the impetus for technology investment and innovation.

Letters:
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 16-18
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 6-8
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 8
South Carolina Department of Health & Environmental Control, OAR-2003-0012-0476 p. 1
10,786 Public Citizens
893 Public Citizens
New York Public Hearing
A-2001-28, IV-D-05 [ALA p. 110; NRDC p. 33; NY PIRG p. 129]
Los Angeles Public Hearing
A-2001-28, IV-D-07 [1 public citizen; ALA p. 220; CA ERA p. 79; U.S. PIRG p. 179; UCS p. 71]
Chicago Public Hearing
A-2001-28, IV-D-06 [ALA p. 284; OEC p. 293; STAPPA/ALAPCO p. 37; U.S. PIRG p. 13]

EPA should accelerate implementation of the standard to help facilitate compliance with the NAAQS. One commenter (SCAQMD) recommended that EPA should phase-in the proposed standards prior to 2010. This commenter noted that based on the SCAQMD 2003 Air Quality Management Plan, significant reductions of about 330 tons per day of DOC and 220 tons per day of NO_x are necessary by 2010 in order to ensure attainment with the federal ozone standards, and that under the current proposal, the NO_x and HC standard would only affect new nonroad diesel engines starting in 2011, and as a result, no reductions from these sources will be achieved by 2010. This commenter also recommended that EPA accelerate the phase-in of these new standard to be consistent with the attainment dates for the federal 1-hour ozone and PM 10 standards or should consider other interim standards for new engines prior to the attainment dates. Another commenter (Houston) noted generally that the proposal's delay until 2013 of controls for the largest equipment impairs their ability to reduce ambient ozone and PM from their own operations. One commenter (TCEQ) added that Texas expects to face 2007 attainment deadlines for the Early Action Compact (EAC) areas and 2010 and 2013 deadlines for other nonattainment areas under the 8-hour standard. This commenter concluded that the nonroad standard schedule will not help the 8-hour nonattainment areas in Texas reach attainment.

Letters:
City of Houston - Office of the Mayor, OAR-2003-0012-0630 p. 2
South Coast Air Quality Management District, OAR-2003-0012-0623 p. 1-2, 5
Texas Commission on Environmental Quality, OAR-2003-0012-0716, 0717 p. 2
Los Angeles Public Hearing, A-2001-28, IV-D-07 [SCAQMD p. 117]

EPA should implement the alternative option 2b as identified in the proposed rule, which would require the implementation of PM standards for nonroad engines over 75 hp by 2011, for nonroad engines between 25 and 75 hp by 2012, and the implementation of the NO_x and nonmethane hydrocarbon standards by the end of 2012. This option provides a cost benefit and would benefit the environment and public health as well.

Letters:
Chicago Public Hearing, A-2001-28, IV-D-06 [CATF p. 258]

EPA's proposal not to advance the Tier 4 PM compliance dates by a year as set out in Option 2b appears to be based on the concern that the PM standards would be decoupled from the NO_x standards, resulting in a large increase in engineering workload for engine and equipment manufacturers. In response to this concern, commenter (CATF) noted that 1) the additional engineering costs have been included in EPA's incremental cost analysis of Option 2b, which are far outweighed by the incremental monetized benefits by a factor of over 13; and 2) it will be feasible to pull-ahead the Tier 4 NO_x standards by a year so that they coincide with the Tier 4 PM standards since there is nothing fundamentally different about applying NO_x adsorber technology to nonroad engines. This commenter concluded that EPA should advance the Tier 4 NO_x standards by beginning the 50 percent phase-in a year earlier than proposed and requiring 100 percent compliance by the end of 2012.

Letters:
Clean Air Task Force, et. al., OAR-2003-0012-0508 p. 13

There is nothing in the CAA that would prohibit EPA from tightening the implementation schedule and there is no reason to assume that Congress intended that EPA rigidly follow the Section 202 directives that call for a 4-year lead time and 3 years of regulatory stability in the nonroad engine context. In setting nonroad engine standards, Section 213 of the CAA directs EPA to "first consider standards equivalent in stringency to standards for comparable motor vehicles or engines (if any)" but offers no guidance on lead time and regulatory stability requirements for nonroad engines. By requiring full implementation of the standards by 2012, EPA will be providing eight years of lead time, which is both legally sufficient and technically feasible, given the technology transfer that is likely to occur from the highway diesel sector.

Letters:
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 17-18

The compliance timeframes set forth in the proposed rule are longer than necessary, and do not reflect the "earliest possible effective dates" as required by Section 213(b). Full compliance with the new standards is not proposed for some engine categories until 2014. The basic technology likely to be used to comply with the nonroad proposal will be in widespread use no later than 2007 in order to comply with the highway rule, but there is a substantial time lag before this technology will be required in nonroad engines. EPA has not provided sufficient explanation regarding why such additional time is necessary. The nonroad compliance dates can and must be accelerated. Even though the diversity of applications associated with nonroad engines can create a logistical compliance issue, the nature of nonroad equipment use generally renders such changes less burdensome than for the highway sector. Other factors that will allow for a more accelerated schedule are that nonroad engine manufacturers have dealt with the issue of adverse operating conditions for years and should be able to incorporate emission control devices, that the ABT program provides sufficient flexibility, and that the costs of emission control technologies will decline over the next 7 to 8 years as they become commercially available due to technology improvements and economies of scale. The commenter provided additional discussion on these issues noting that the compliance timeline should be consistent with the time allowed under the highway rule, which would necessitate a compliance date for 15 ppm diesel fuel of 2009 and Tier 4 compliance dates that are a full year earlier than proposed.

Letters:
Clean Air Task Force, et. al., OAR-2003-0012-0508 p. 10-13

Our Response:

Section II.A of the preamble to this final rule includes detailed discussion of comments requesting acceleration of Tier 4 standards. We note in addition that Option 2b in the NPRM alternatives, advocated by some commenters, involves a coordinated acceleration of 15 ppm fuel and Tier 4 engine standards, as it is the fuel change that enables the technologies upon which the engine standards are based. See Chapter 5 of the RIA and our response to Issue 4.2.2 for discussion on constraints to timing for the fuel change apart from coordination with engine standards. Even if the fuel change could be accelerated, there would be problems for setting earlier Tier 4 standards due to, for example, overlap with Tier 3 standards and a lack of adequate lead time to transfer technology from the highway sector. Refer to Section 12.4.2.3 of the Draft RIA that accompanied our proposal for a detailed discussion of this option. Also see Section 2, and especially our response to Issue 2.2.4.3, regarding how this rule affects attainment of the NAAQS.

3.1.1.4.2 The Timeline May Not Be Feasible

What Commenters Said:

There is significant uncertainty regarding whether the technologies required by this rule can be developed and implemented within the proposed time frame. The transfer of highway technology can be costly, time consuming, and in some cases, infeasible. The lack of durability of PM and NO_x control devices under transient conditions may cause significant problems. In addition, nonroad equipment duty cycles may not provide the steady state, high load operation required for regeneration of the catalyzed particulate filter. EPA should not assume that emission control strategies can be developed for on-highway use and then simply transferred to nonroad applications. The potential equipment failures would negatively impact users, dealers, and manufacturers alike. In addition to these concerns, some engine manufacturers may be able to comply with the highway rule by modifying engine architecture rather than by using aftertreatment devices, thus delaying the implementation of NO_x aftertreatment until 2010 or later. This delay may have an adverse effect on the ability of nonroad engine manufacturers to transfer this technology in time to comply with the Tier 4 rule.

Letters:
Associated Equipment Distributors, OAR-2003-0012-0831 p. 3
Ingersoll-Rand, OAR-2003-0012-0504 p. 6
New York Public Hearing, A-2001-28, IV-D-05 [IR p. 224]

An adequate period of stability is necessary between different tiers or sets of standards. This period should be at least 3 years. Having the time to develop the necessary technologies, first for the highway market and then for the much wider range of nonroad engines is crucial. Providing adequate lead time creates stability for the manufacturers. The highway standards will require a significant capital investment, and the manufacturers must be given adequate time to recoup this investment. In addition, the diversity of nonroad engine models will make it difficult to implement design changes across the entire range of product lines. Given these concerns, EPA must provide adequate compliance flexibility to allow manufacturers and aftertreatment suppliers to meet the standards while producing engines with a high level of performance. Failure to do so may lead to problems with the reliability and performance of compliant nonroad engines. One commenter (CNH Global) noted that this issue is particularly relevant for engines between 50 and 174 hp that require implementation by 2012. Some commenters (AEM, Cummins, EMA, John Deere) noted that EPA has proposed two compliance options in the Tier 4 standards for engines between 75 and 175 hp (56 and 130 kW); one option has two years of stability and the other has two years and nine months, which is unacceptable and contrary to the CAA. One commenter (John Deere) suggested that EPA eliminate the first option entirely and finalize a 3.3 gram per kilowatt hour NO_x standard effective January 1, 2015 without phase-in percentages. This commenter provides significant additional discussion including sales and volume data for their products and a detailed explanation of why creating different power categories or providing additional equipment flexibility credits does not address the lack of stability in this case. Other commenters (AEM, Cummins) recommended generally that the final rules for these engines incorporate a compliance deadline of 2015. One of these commenters (AEM) reiterated in this context, that the power cutpoint should be raised to 100 hp, in which case the 2015 deadline would apply to the 100 to 175 (75 to 130 kW) category (see related discussion under Issue 3.1.5). One commenter (EMA) provided additional discussion regarding this issue and the feasibility of the proposed implementation schedules. Another commenter (Euromot) noted that at least four years is needed between implementation of the highway rule in 2007 and the effective dates of the Tier 4 standards to ensure adequate technology transfer to nonroad engines. This commenter added that most manufacturers of on-highway engines will use the split-family approach instead of the 50 percent NO_x phase-in, since NO_x aftertreatment is unlikely to be available by 2007, and that if these technologies are not introduced into the highway sector until 2010, manufacturers will have difficulty transferring this technology to the nonroad engine by 2011.

Letters:
American Road and Transportation Builders Association, OAR-2003-0012-0633 p. 2
Associated General Contractors of America, OAR-2003-0012-0791 p. 11
Association of Equipment Manufacturers, OAR-2003-0012-0669, 0670 p. 10-11
Cummins, Inc., OAR-2003-0012-0650 p. 8
Deere & Company, OAR-2003-0012-0692 p. 2-4
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 15-17
Euromot, OAR-2003-0012-0822, 0823 p. 3-5
New York Public Hearing, A-2001-28, IV-D-05 [EMA p. 102; Deere p. 56]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [EMA p. 151-155; Cummins p. 37]
Chicago Public Hearing

A-2001-28, IV-D-06 [AEM p. 224; CNH p. 66; EMA p. 29-31; Euromot p. 233]

Aside from the issue of adequate stability between different tiers, an adequate period of stability is also needed for the time period between finalization and implementation of the rule in order to provide the necessary design and development lead time between changes in standard levels. This is particularly important since the transfer of technology from onroad to nonroad equipment will be challenging. Some commenters (AEM, John Deere) noted that four years is the minimum time needed to make the necessary engine and machine changes. These commenters noted in this context, that the lead time is adequate with the exception of the optional Tier 3 2008 PM standard for the 50 to 75 hp (37 to 56 kW) category. Manufacturers may not be able to apply particulate aftertreatment to these smaller engines prior to 2013. It would require the implementation of particulate aftertreatment to the majority of power makers (i.e. between 37 and 560 kw) in only two years, 2011 and 2012, which would be an enormous burden. Commenters provide additional discussion on this issue and recommend that EPA implement a 2013 deadline for particulate aftertreatment for those engines below 75 hp (56 kW). (See additional discussion under 3.1.4)

Letters:
Associated General Contractors of America, OAR-2003-0012-0791 p. 11
CEMA-CECE, OAR-2003-0012-0598 p. 2
CNH Global, OAR-2003-0012-0819 p. 6
Deere & Company, OAR-2003-0012-0692 p. 2-4
Euromot, OAR-2003-0012-0822, 0823 p. 3-5
Ingersoll-Rand, OAR-2003-0012-0504 p. 10-11
New York Public Hearing, A-2001-28, IV-D-05 [EMA p. 102; Deere p. 55]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [EMA p. 152]
Chicago Public Hearing, A-2001-28, IV-D-06 [EMA p. 28]

EPA is moving forward with the development and implementation of a nonroad rule within the span of a few years, despite the fact that it took decades to work through the onroad program. Moving too quickly is a recipe for failure. Agricultural and construction equipment, while sharing diesel as a main power source with onroad trucks and buses, have little else in common with onroad vehicles. Nonroad equipment runs at much slower speeds and often at a higher rpm on rough terrain and in dusty and dirty conditions. The development and implementation of a rule that can account for these factors will take more time that EPA anticipates.

Letters:
Far West Equipment Dealers Association, OAR-2003-0012-0679 p. 2-3
North American Equipment Dealers Association, OAR-2003-0012-0647 p. 2-3
Ohio-Michigan Equipment Dealers Association, OAR-2003-0012-0747 p. 2-3
USA Rice Federation, OAR-2003-0012-0652 p. 2-3

EPA should refrain from implementing emissions standards until emissions reduction technology has been developed and has been demonstrated to be adequately effective with low-sulfur diesel fuels in all nonroad applications. Adequate emissions control technology should be available in the market for several years prior to standards taking effect.

Letters:

Associated General Contractors of America, OAR-2003-0012-0791 p. 11

From a timing perspective, the Tier 4 requirements for PM aftertreatment are consistent with EU Stage IIIB. However, the proposed rule contains aftertreatment forcing NO_x standards (50 percent phase-in or as an option the split family limit values) that are inconsistent with the Stage IIIB proposal. The Tier 4 proposal should be aligned with the EU Stage IIIB proposal.

Letters:
Euromot, OAR-2003-0012-0822, 0823 p. 4

The proposed rule provides adequate time for engine manufacturers to integrate the emissions control systems into the affected engine families, but does not provide adequate lead-time for OEMs to produce the most cost effective and reliable equipment. This lack of lead time for OEMs may lead to an increase in the cost of equipment and may have an adverse effect on the end-user, including those who rent equipment.

Letters:
American Rental Association, OAR-2003-0012-0612 p. 2

If engine manufacturers use increased EGR rates to achieve the model year 2007 NO_x standard, NO_x aftertreatment components will not be widely used until 2010. Several engine manufacturers reported at the EPA Clean Truck Workshop held in August 2003, that they will be taking this approach. This delay will reduce the technology transfer lead time to nonroad from 4 years to 1 year. EPA has not addressed this concern in the proposed rule and should do so in order to accurately assess whether the Tier 4 rule can be successfully implemented within the proposed time frame.

Letters:
CNH Global, OAR-2003-0012-0819 p. 3-4

EPA's Tier 1 regulation accounted for the following factors in setting the scope of the standards and the implementation schedule: 1) the CAA authorized California to set nonroad standards for engines at or above 175 hp; 2) engine manufacturers and equipment manufacturers did not have the resources or facilities to implement the Tier 1 standards for all engines on the same date; 3) for engines under 175 horsepower, it is more difficult to transfer on-highway technology and the market is more cost sensitive; and 4) there are many more applications under 175 horsepower than above. In contrast, EPA's Tier 4 standards considered only one factor - the technology transfer issue, but the other three factors remain extremely important as well as international harmonization. Since engineering resources to design products for Tier 4 engines will double, there is an even greater need for staggered introduction dates. To address this issue, EPA should 1) eliminate the pull ahead Option 1 and move the effective date to 2013 for engines in the 37 to 55 kW range; 2) move the effective dates for interim and final standards to 2013 and 2016, respectively, for engines in the 56 to 74 kW range; and 3) move the effective date for a final standard to 2015 for engines in the 75 to 129 kW range.

Letters:
CNH Global, OAR-2003-0012-0819 p. 6

For engines between 19 kW and 56 kW, EPA should provide a phase in schedule that is similar to the schedule for engines greater than 56 kW. The phase-in for these smaller engines should be 50 percent in 2013, 50 percent in 2014, and 100 percent in 2015.

Letters:
Yanmar, OAR-2003-0012-0615, 0813 p. 5

Ingersoll-Rand commented that the NO_x phase-in should be tied directly to a calendar year schedule. They believe that we should set January 1, 2015 as the date for implementing the NO_x standard for engines rated between 100 and 175 hp. Currently, the proposal calls for 100 percent phase in of the NO_x standard by the end of September 2014, which they believe will unnecessarily complicate equipment manufacturers' schedule for production and use of flexibility allowances.

Letters:
Ingersoll-Rand, OAR-2003-0012-0504 p. 12

Our Response:

As is described in Sections II and III of the preamble to this final rule and in Chapter 4 of the RIA, we have determined that the amount of lead time available, combined with a number of provisions for implementation flexibility for engine and equipment manufacturers, will allow the manufacturers to develop and apply the new emission control technologies in time to meet the new standards. We do not agree that a percent phase-in, which was proposed for engines above 75 hp to align their phase-in of aftertreatment NOx standards with parallel standards for highway engines, is needed for engines below 75 hp which do not have an aftertreatment-based NOx standard, nor do we see another valid basis for adopting a percent phase-in for <75 hp engines.

As is evident in those discussions, we have not simply assumed that emission control technology derived from experience in the highway sector can be transferred to the diverse nonroad sector, but have evaluated the technological feasibility of new standards specifically for the nonroad sector. Regarding the potential for mismatched implementation paths should the highway engine manufacturers choose to comply with 2007 standards without the use of advanced NOx aftertreatment devices, we note that we intentionally set up the NOx phase-in approach for nonroad engines with this possibility in mind, with alternative implementation approaches allowed that are parallel to those in the highway program. See Issues 3.2.1.2 and 3.2.2.1, as well as RIA sections 4.1.1.3.2 and 4.1.3.1.1, for discussions on the commenter's concern that the duty cycles of these engines may not be conducive to PM filter regeneration.

In response to comments suggesting that EPA should wait until technologies have been proven, or until uncertainties have been removed, we note that under Section 213 of the Clean Air Act, the nonroad engine "standards shall achieve the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the engines or vehicles." This requirement clearly allows and even requires that we project the development of technology during the lead time we provide, and we have done so in this rule. Commenters who made generalized statements about uncertainties that exist at this time did not describe how the existence of such uncertainties today render EPA's assessment of feasibility in the lead time provided inadequate.

The rule contains a number of features designed to ensure adequate lead time. These include providing stability between new sets of standards (e.g., the interim and final standards for 25-75 hp engines), and establishing flexibility for engine and equipment manufacturers (e.g., the ABT and equipment manufacturer flexibility provisions). We also have made a number of changes from the proposal to further ensure that these combined provisions will result in adequate lead time, including changes affecting the power categories focused on by commenters. A detailed discussion of the adequacy of the lead time provided for the 2008 Tier 4 standard for 50-75 hp engines is provided in Section II.A.1.a of the preamble. We also note that, in response to the comments here, we have extended the compliance date for full compliance with Tier 4 aftertreatment-based NOx standards for 75-175 hp engines using the 25%-25%-25% phase-in option until December 31, 2014. (See Preamble section II.A.2.b.) For a discussion of issues relating to harmonization with standards in Europe, see preamble Section II.A.8.

The concerns raised by CNH over the lack of implementation flexibility in Tier 1 have been addressed in subsequent tiers, including this Tier 4, through the addition of flexibility provisions. We agree that it may be more difficult to transfer highway technology to engines below 175 hp, but we believe that we have addressed this concern and the concern about spreading the redesign workload burden for the many machine models in this category by setting Tier 4 standards for these engines to begin in 2012 (one year later than for larger engines), by providing multiple compliance options, and through the design of the equipment manufacturer flexibility program.

3.1.2 Over 750 hp Engines

3.1.2.1 Standards Should Be Equally Stringent for All Engine Categories

What Commenters Said:

A few commenters stated that the standards for engines greater than 750 hp should be just as stringent as those for other engine categories. They believe that these engines should be subject to the same NO_x and PM standards as the 75 to 750 hp engines and implementation of the standards should be completed by 2012. Commenters stated that we should require 50 percent of these engines to comply by 2011 and the remaining 50 percent to comply by 2012, as they believe that these engines are small in number (nationally comprising only 0.3 percent of annual nonroad engine sales), but are disproportionately high in their local impact (emitting 6 percent of national nonroad diesel PM). The commenters noted the example of mining equipment in Bingham Canyon, which borders Salt Lake City, contributing 25 percent of Salt Lake County's total PM10 pollution. However, they add, given the unique challenges presented by these engines, we could consider "opt-out" provisions on a case-by-case basis.

Further, Environmental Defense commented that we should require engines over 750 hp to meet the same standards in the same time frame as engines below 750 hp, since any decision to the contrary would violate EPA's delegated rulemaking responsibilities under the operative provisions of the CAA. They believe that we should not accept the argument that engines over 750 hp should have their own special category, and stated that the D.C. Circuit has previously affirmed EPA's decision not to create a separate, special category for these engines. Environmental Defense offers the example of Engine Manufacturers Assoc. v. U.S. EPA., 88 F.3d 1075, (D.C. Cir. 1996), in which EMA challenged the EPA regulations promulgated under Section 213 for surface mining equipment. The court held that EPA was not arbitrary or capricious in classifying surface mining engines with construction or large CI engines and cited statistics about mining equipment being used in nonattainment areas for determining that the "cause or contribute" trigger had been met under Section 213(a)(3).

Many public citizens commented that EPA should ensure that large equipment greater than 750 hp used in the mining industry are also subject to the same standards as equipment below 750 hp since the rule provides ample time for the manufacturers of mining equipment to make the adjustments necessary to meet the standards and since this approach would reduce overall pollution in communities that are in close proximity to mines.

Letters:
Environmental Defense, OAR-2003-0012-0821 p. 9
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 21-22
Salt Lake City, OAR-2003-0012-0787 p. 1
Union of Concerned Scientists, OAR-2003-0012-0830 p. 7
Chicago Public Hearing, A-2001-28, IV-D-06 [ALA p. 284]
4,320 Public Citizens
170 Public Citizens

Our Response:

See our response to Issue 3.1.1.1.2

3.1.2.2 The Over 750 hp Engine Standards Are Too Stringent

What Commenters Said:

Cummins and Komatsu commented that the standards for those engines greater than 750 hp are too stringent. They stated that these engines fall outside the range of on-highway power and experience, yet EPA has specified the same implementation dates as the highway engines with a similar range of power. They believe that developing aftertreatment systems for these engines and applications poses unique challenges for many manufacturers; there are no on-highway engines of this size that have demonstrated DPF or NO_x reduction technology and thus, there is no basis to assume that there can be a technology transfer. Both commenters noted that these engines only represent 1 percent of total nonroad engine sales and the investment necessary to meet the standards would be substantial. Cummins also noted that regulatory changes in this single category will impact seven of their engine platforms which provide power from 750 to 3,500 hp. Both Cummins and Komatsu provided additional discussion on this issue and requested that we address the stringency of the standards for these larger engines by reviewing the overall proposal for this category and/or postponing the imposition of technology-forcing standards.

DDC and EMA commented that given the numerous significant and unique technological challenges related to the greater than 750 hp power category, a transfer of on-highway technologies is not feasible in all cases. However, they believe that there is a potential opportunity in this category of engines given the fact that there are two distinct mobile source applications; portable power generation equipment and other mobile machines. They believe mobile machinery category, such as large earth-moving and mining equipment, presents the most costly and technically challenging problems- stating that these applications have multiple duty cycles, substantial space constraints and are often subject to high shock loads. Further, they stated, this equipment is often used in dusty and harsh environments that are not located in highly populated areas. In contrast, power generation equipment has constant speed duty cycles and, comparatively, less limiting space constraints and since it is stationary when operated, it is relatively free from mechanical shock loads. EMA and its members recommended that we recognize the difference between these two types of engines and require only those engines used in mobile power generation to install aftertreatment devices. We could then conduct a feasibility review in the 2013 to 2014 time frame to assess the costs and technical challenges of further expanding the standard. EMA believes that reductions from other large nonroad sources should be required only if it is technologically feasible and in any case, not prior to 2018.

Further, DDC and EMA added, the proposed NO_x FEL of 3.1 g/kW-hr is too stringent and should be changed to 3.5 g/kW-hr to allow manufacturers to achieve the significant reduction in PM. 3.5 g/kW-hr represents an approximate mid-point between the 6.4 g/kW-hr previous NO_x limit and the appropriate next Tier NO_x limit. They stated that this limit would be approximately 44 percent lower than the previous Tier NO_x standard for this large power category and along with the 50 percent reduction in PM, will provide significant emission reductions in a power category that only represents 1 percent of sales and 5 percent of the total emissions inventory. The commenters added that the final NO_x limit is also too stringent and represents a 94 percent reduction from the previous Tier. If on-highway NO_x aftertreatment devices can be applied to greater than 560 kW engines, then a 90 percent reduction would be assumed. They believe, therefore, that the final NO_x limit should be 0.64 g/kW-hr, not 0.40 g/kW-hr as proposed.

Cummins also commented that they believe that the proposed interim NO_x level for engines greater than 560 kW should not be a result of a calculation based on a 50/50 phase-in strategy that will not be used. They believe the interim NO_x level should be one that provides manufacturers with cost effective and technically feasible alternatives and should be based on applying aftertreatment with the same efficiencies to the greater than 560 kW Tier 2 engines as those for the 130 to 560 kW Tier 3 engines. They suggested that we should finalize the 2011 interim Tier 4 standards for these larger engines at 3.5 g/kW-hr NO_x and 0.10 g/kW-hr PM, which represent a 44 percent and 50 percent NO_x and PM reduction, respectively, from Tier 2 levels. And added that we should finalize 2015 Tier 4 standards at 0.64 g/kW-hr NO_x and 0.02 g/kW-hr PM, which should only apply to mobile power generation equipment. Finally, Cummins stated, these final Tier 4 standards should apply to other mobile machinery no earlier than 2018.

A few commenters (Murphy, NMA, and the Western Business Roundtable (WBT)) stated that given the unique and customized nature of mining equipment engines over 750 hp, we should exempt this equipment from the Tier 4 standards. WBT specifically recommended that we provide a specific cost-benefit analysis that addresses the continued exemption of engines in this sector.

Lastly, Komatsu commented that we should revise the phase-out standards to require the use of diesel PM filters only for engines 560 kW and below and Tier 2 standards for engines over 560 kW. Therefore, any rule changes that affect NO_x emissions, such as the transient test requirement, NTE requirements, and the revised definition of test speed should be eliminated for phase-out engines to avoid additional NO_x re-design development expense.

<u>Letters:</u>
Cummins, Inc., OAR-2003-0012-0650 p. 3-5
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 4
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 21-23, 111

Komatsu, OAR-2003-0012-0455 - 0457 p. 2-3
Murphy Oil, OAR-2003-0012-0212 p. 4
National Mining Association, OAR-2003-0012-0510 p. 2-3
Western Business Roundtable, OAR-2003-0012-0636 p. 4
Los Angeles Public Hearing, A-2001-28, IV-D-07 [Cummins p. 37]

Our Response:

See our responses to Issue 3.1.2.3 and 3.3.1.

3.1.2.3 Compliance Deadline

What Commenters Said:

DDC and EMA commented that we should extend the compliance deadline for engines greater than 750 hp. They believe that standards for nonroad engines (> 750 hp) should not be implemented any sooner than January 2015 and the final application of high efficiency aftertreatment systems should be limited only to power generation applications, since even for these engines, it is not possible to meet the Tier 4 limits by January 2014. They added that engine and equipment manufacturers require more than a 3 year period of stability. Due to the low sales volume and high costs associated with these engines, these commenters believe that we should only implement standards at this time for the power generation applications, should not require implementation of these standards prior to January 2015, and should expand the flexibility provisions for the Tier 4 interim standards. (See related discussion under Issues 3.1.1 and 3.2.2).

AEM added that the proposed program implementation provisions for engines greater than 750 hp do not adequately address the manufacturers' timing concerns. They believe that we should move the introduction date until 2012 (one additional year) before beginning to phase in Tier 4 standards for this category. AEM believes that mobile machinery such as off-road mine haul trucks and bulldozers present unique challenges that could require more time to resolve than would be afforded by the proposed phase-in completion date.

Letters:
Association of Equipment Manufacturers, OAR-2003-0012-0669, 0670 p. 11
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 4
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 22, 111

Our Response:

We believe that it is appropriate to adopt different Tier 4 standards for over 750 hp engines from those we proposed, and to adopt different implementation dates for these engine standards. The approach being adopted reflects our careful review of the technical issues presented by these engines. For some of these engines, we are accelerating standards based on the use of aftertreatment controls. For others, we are deferring a decision on such aftertreatment-based standards. This approach represents a feasible and efficient approach to redesigning engines and installing aftertreatment in a coordinated, orderly manner over a decade or more, and will achieve major reductions in PM and NOx emissions from these large diesel engines. See Section II.A.4 of the preamble to this final rule and Section 4.1 of the RIA for more discussion of this issue. We believe that the approach we are taking in the final rule addresses the comments raised by engine and equipment manufacturers about feasibility, lead time and time needed to redesign low-volume engines and machines.

3.1.2.4 Diesel Generating Sets

What Commenters Said:

WESTAR commented that we should streamline the definitions and control strategies for diesel generating sets. Dependent on their usage and mobility, identical generator sets may be classified as stationary or mobile units. Control and permitting requirements can differ for identical technologies depending on this classification. They believe that we should consider addressing this issue in a future rulemaking.

Letters:
Western States Air Resources Council, OAR-2003-0012-0711 p. 2

Our Response:

This rulemaking's engine standards are being adopted under the provisions of Clean Air Act Title II, "Emission Standards for Moving Sources". Title II does not grant EPA authority to regulate stationary sources. See our response to Issue 3.1.1.2. However, there is nothing in the regulations we are setting that would prevent manufacturers from selling engines certified to these new standards for use in stationary applications, should they choose to do so, and in fact this practice is common today under our pre-Tier 4 standards.

3.1.3 75-750 hp Engines

What Commenters Said:

CNH commented that, in the 50 to 175 hp range, we should revise the power categories and introduction dates. They believe that Tier 4 should use the same power categories and staggered introduction dates that were used with the Tier 1, 2, and 3 regulations.

John Deere commented that, for engines between 56 and 130 kW, we should replace the two phase-in options with one NO_x + NMHC standard of 3.3 g/kW-hr. They stated that the first option, which allows for the use of Tier 2 ABT credits and has a 50/50 phase-in/phase-out until 2014, should be eliminated since it adds unnecessary complication to the rule and since it is unlikely that there will be enough Tier 2 credits available to make it the preferred option for any manufacturer. Further, they believe that phase-in/phase-out approach should be eliminated since it adds unnecessary complication, particularly with respect to harmonization with Europe. (See additional discussion under Issues 3.1.1.3).

Letters:
Deere & Company, OAR-2003-0012-0692 p. 2

Chicago Public Hearing, A-2001-28, IV-D-06 [CNH p. 67]

Our Response:

As is described in Section II.A.5 of the preamble to this final rule, we continue to believe that the power categories being used are appropriate. See also our response to Issue 3.1.5.1. We discuss our reasons for retaining two compliance options for 56-130 kW engines in Section II.A.2.b of the preamble for this final rule. Regarding the comment about dropping the phase-in approach, see our response to Issue 3.1.1.3.

3.1.4 Under 75 hp Engines

3.1.4.1 The Proposed <75 hp Standards Should Be More Stringent

What Commenters Said:

The standards for engines less than 75 hp should be just as stringent as those proposed for the engines greater than or equal to 75 hp. There is a very large number of these engines and given the significant risk they pose to the public, they should be controlled to mitigate the effects of the toxic hydrocarbon emissions. Emission control technologies that would achieve a 90 to 95 percent reductions in NO_x and PM should be required for nonroad diesel engines between 25 and 75 hp. In addition, more stringent standards for engines less than 25 hp must be set to control toxic hydrocarbon emissions from these smaller engines. Some commenters (ED, NY) specifically recommended that all engines should meet the PM standard of 0.01 g/bhp-hr, the NO_x standard of 0.30 g/bhp-hr standard for NO_x and a 0.14 g/bhp-hr standard for NMHC no later than 2012.

<u>Letters:</u>
Environmental Defense, OAR-2003-0012-0821 p. 7-8
Massachusetts Department of Environmental Protection, OAR-2003-0012-0641 p. 2
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 5-6
NESCAUM, OAR-2003-0012-0659 p. 5
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 19-20
Pennsylvania Department of Environmental Protection, OAR-2003-0012-0699 p. 3
Regional Air Pollution Control Agency, OAR-2003-0012-0683 p. 1-2
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 8
South Coast Air Quality Management District, OAR-2003-0012-0623 p. 2-3, 5
U.S. Public Interest Research Group, OAR-2003-0012-0780 p. 3
Union of Concerned Scientists, OAR-2003-0012-0830 p. 5-6
Wisconsin Department of Natural Resources, OAR-2003-0012-0702, 0703 p. 2
New York Public Hearing
A-2001-28, IV-D-05 [STAPPA/ALAPCO p. 45; U.S. PIRG p. 190]
Los Angeles Public Hearing
A-2001-28, IV-D-07 [STAPPA/ALAPCO p. 26; U.S. PIRG p. 179; UCS p. 70]
Chicago Public Hearing, A-2001-28, IV-D-06 [STAPPA/ALAPCO p. 36]

EPA should take into consideration the control capability of diesel oxidation catalysts (DOC) and should set the standards for engines less than 75 hp, accordingly. If the standards are too lenient, DOCs may not be used, and an important opportunity to protect the equipment user and the public from PM and HC emissions will be lost. One commenter (MECA) noted that DOCs are capable of reducing total PM by up to 50 percent and toxic HC by up to 70 percent. This commenter noted that the proposed PM standard for engines less than 25 hp can be met with engine modifications alone and is not sufficiently stringent to necessitate the use of DOC technology. Another commenter (CARB) noted that since the proposed PM standards for engines from 25 to less than 75 hp do not reach the final filter-based level until 2013, there is no lead-time impediment to requiring the use of oxidation catalysts in the interim.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 5
Environmental Defense, OAR-2003-0012-0821 p. 8
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 7
Los Angeles Public Hearing, A-2001-28, IV-D-07 [CARB p. 15; MECA p. 61]
Chicago Public Hearing, A-2001-28, IV-D-06 [MECA p. 49]

EPA should also extend the more stringent aftertreatment based standards to engines under 75 horsepower. Engines under 75 hp account for a significant portion of nonroad emissions. More stringent standards for 2008 are supported by Section 213 of the CAA since they are achievable through the use of oxidation catalysts and the optimization of engine performance. One commenter (NRDC) recommended that EPA finalize PM standards at 0.2 and 0.15 g/bhp-hr for engines < 25 hp and 25 to 75 hp, respectively, by 2008, and that all engines less than 75 hp be subject to aftertreatment-based PM and NO_x standards, and that given the large number of these engines and the risk they pose due to air toxics exposure, EPA should finalize stronger standards to reduce the toxic hydrocarbon emissions. This commenter added that the more stringent 2012 standards are achievable given the long lead time and EPA should reject industry claims for delay, exemption or weakening of the standards and timetables for these engines. One commenter (UCS) also recommended an interim PM standard for engines 25 to 75 hp of 0.15 g/bhp-hr. Another commenter (West Harlem) expressed concern that the more lenient standards for these engines could encourage consumers to use multiple smaller engines in lieu of a larger engine that would be subject to more stringent emission standards.

Letters:
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 19-20
Union of Concerned Scientists, OAR-2003-0012-0830 p. 5
New York Public Hearing, A-2001-28, IV-D-05 [NRDC p. 34; W. Harlem EA p. 261]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [NRDC p. 55]

The standards for engines less than 25 hp should be more stringent. One commenter (CARB) noted that small diesel engines under 25 hp will comprise at least 20 percent of all nonroad land-based diesel engines in California by 2010, and this percentage will continue to grow. This commenter added that the proposed level of control for these engines, at an approximate 50 percent reduction for PM, doesn't go far enough to protect public health and that EPA should establish more stringent PM and hydrocarbon standards for this group of engines for the 2008 model year based on the use of oxidation catalysts and eventually, PM filter technology (and if more stringent standards are not promulgated, EPA should at the very least, reduce or eliminate the number of flexibility options proposed for these engines). One commenter (WI) added that reactive hydrocarbon emissions remain an important piece of Wisconsin's ozone nonattainment picture. One commenter (MECA) recommended that EPA set tighter

PM and NO_x standards for these engines effective in the 2012/2013 timeframe, given that additional cost-effective NO_x and PM control strategies such as lean NO_x catalysts and low efficiency DPFs (capable of reducing NO_x and PM by 25 percent and 50 to 60 percent, respectively), may emerge for these smaller engines. One commenter specifically recommended that EPA set a PM standard for engines less than 25 hp at 0.2 g/bhp-hr.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 4-5
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 7
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 5-6
Regional Air Pollution Control Agency, OAR-2003-0012-0683 p. 2
Union of Concerned Scientists, OAR-2003-0012-0830 p. 5
Wisconsin Department of Natural Resources, OAR-2003-0012-0702, 0703 p. 2
New York Public Hearing
A-2001-28, IV-D-05 [ALA p. 111; CARB p. 140-142; NY DEC p. 13]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [CARB p. 15]

EPA has failed to propose adequate HC standards for engines less than 75 hp, which results in the loss of an important opportunity to reduce exposure to toxic HC emissions. EPA should apply the 0.14 g/bhp-hr NMHC standard that currently applies to engines 75 hp and greater, to engines in the 25 to less than 75 hp category. For engines in the 25 to 50 hp range, this standard should take effect in 2008, and for engines from 50 to 75 hp, this standard should take effect at the earliest possible date consistent with providing four years lead-time and three years stability with the existing NMHC standard.

Letters:
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 7

Unless EPA tightens the emission control requirements for diesel engines in the 25 to less than 75 hp category, an inequity will be created between the emission control requirements for similar-sized SI and CI nonroad engines. Manufacturers of diesel engines in this category have the option of meeting very modest HC+ NO_x standards until 2012 that will be met with relatively inexpensive engine modifications. This situation could create the unintended consequence that the market share of higher polluting diesel engines will increase at the expense of the very low emitting gasoline, CNG, and LPG fueled-engines. One commenter (UCS) recommended that EPA consider developing harmonized emissions standards for gasoline and diesel engines to prevent manufacturers from taking advantage of the higher allowable emissions afforded by the different standards and switching fuels.

Letters:
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 8-9
Union of Concerned Scientists, OAR-2003-0012-0830 p. 6

EPA has proposed two compliance options for engines from 25 to less than 75 hp. Some manufacturers have called for the elimination of the interim PM standard under Option 1 since it does not meet the 3-year period of stability. However, if EPA decides to drop Option 1, the effective date for meeting the 0.02 g/bhp-hr PM standard should remain as 2012, since it is technologically feasible. Option 1 provides an opportunity to reduce harmful toxic HC and PM exposure to the equipment operators during the period from 2008 to 2013. However, to maximize the potential benefits of this option, the interim 0.22 g/bhp0-hr PM standard should be tightened to take advantage of the emission reduction potential of DOCs. EPA should adopt a PM standard in the range of 30 percent more stringent than currently proposed.

Letters:
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 8

EPA's proposed standards for smaller engines 25 to 75 hp, clearly violate its statutory duty since over 10 percent of these engines are already capable of meeting the proposed 2008 PM standard. Many of these engines already meet this PM standard by using only engine-out technology. Also, more than 90 percent of the engine families in the 25 to 50 hp range are meeting the proposed CO standard today. In light of these observations, EPA should set more rigorous emissions standards for these engines.

Letters:
Environmental Defense, OAR-2003-0012-0821 p. 8

EPA should tighten the 2008 PM standard for engines rated at less than 75 hp to 0.1 g/bhp-hr, which would be consistent with the PM highway standards that have been in effect since 1994. In addition, the NO_x + NMHC standard of 3.5 g/bhp-hr for engines from 25 to 75 hp does not meet the requirements of Section 213(a)(3) that standards achieve the greatest reductions possible and does not reflect recent developments in combustion and emissions control. EPA's rationale for the lenient standard for engines in the 25 to 75 hp category is that NO_x adsorbers may not be available for these small engines. However, despite this concern, there will be other control options available for these engines which could provide deeper emission reductions on an earlier timeframe than EPA has proposed. NO_x controls with efficiencies in the 30 to 50 percent range potentially may be used for some equipment that use pre-chamber diesels, which have lower uncontrolled NO_x emissions that are in the 3 to 4 g/bhp-hr range. With some development and the use of EGR, engine-out levels as low as 1.5 g/bhp-hr may be attainable. Therefore, this commenter (CATF) recommended that this standard should be lowered to between 1.5 and 2.0 g/bhp-hr and should be implemented by 2012 at the latest.

Letters:
Clean Air Task Force, et. al., OAR-2003-0012-0508 p. 14-15

Our Response:

These comments are addressed in the preamble to this final rule (See Sections II.A.3.a and II.A.3.b). We have determined that the standards being adopted for engines under 75 horsepower are the most stringent standards that are technologically feasible considering costs and other relevant factors. See also preamble Section II.B.4 and RIA Section 4.1.4 for more detailed discussions of this determination. Harmonization issues are discussed in preamble Section II.A.8, and issues relating to the appropriateness of the cutpoints established in the rule are discussed in preamble Section II.A.5. Regarding Environmental Defense's comment on CO standards, see our responses to Issues 3.1.1.1.4 and 3.1.4.5. Our justification for the flexibility provisions we are adopting is discussed in detail in Section III of the preamble. We do not believe that reducing or eliminating these flexibility provisions for this category of engines is appropriate. We also do not believe that the standards we are setting will discourage non-diesel-fueled engines. To the extent that cleaner alternatives can meet the Tier 4 standards with less design modification from today's engines than will be required for diesels, they will become more cost-competitive in the Tier 4 timeframe.

3.1.4.2 Opposed to Stringent PM and NMHC Standards in 2008

What Commenters Said:

A few commenters (Ingersoll-Rand and Euromot) commented that the proposed PM standards for engines between 19 and 37 kW (25-50 hp) are too stringent and may not be feasible or cost-effective. They stated that smaller engines may not be able to meet the PM standard by 2008. This type of power source is crucial within the construction and agricultural community and attempting to meet the proposed standards may compromise the advantages of these smaller machines. Some commenters (Euromot, Lister-Petter (LP)) noted that EPA's PM limit of 0.3 g/kW-hr is not achievable with current DI engine technology and provide additional discussion on this issue, noting that a PM limit of 0.45 g/kW-hr could be met in this time frame if a practical phase-in scheme and flexibility provisions for small volume products are provided. One of these commenters (LP) noted that this standard would help encourage the continued use of the efficient DI combustion technology. Commenters (IR, LP) noted that the continued use of DI engines is essential in this power range because of their lower heat rejection and significant fuel economy benefits when compared with indirect injection (IDI) engines.

Letters:
Euromot, OAR-2003-0012-0822, 0823 p. 6
Ingersoll-Rand, OAR-2003-0012-0504 p. 10, 13-14
Lister Petter, OAR-2003-0012-0155 p. 2
Chicago Public Hearing, A-2001-28, IV-D-06 [Euromot p. 235]

The stringency of the standards for engines from 19 to 37 kW are inconsistent with other on-highway and international standards. Highway engines provide the basis from which to design the nonroad engines and currently, EPA's large spark-ignited engine regulations use 37 kW as the lower limit for stringent emission levels on gasoline engines. In addition, in Europe, amendments to NRMM Directive 97/68/EC establish particulate trap-forcing standards only for engines over 37 kW. If this disparity remains, engine and equipment manufacturers will have to design and introduce PM traps for a very limited market. The resulting higher cost of the engine would adversely impact the viability of this market segment and the implementation of the relevant Tier 4 standards.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 24
Ingersoll-Rand, OAR-2003-0012-0504 p. 10, 13-14

Euromot commented that the proposed PM limit for engines below 19 kW (25 hp) is too stringent. They believe that we should expand the intended relief for engines less than 8 kW to engines between 8 and 19 kW, as hand start engines between 8 and 19 kW are an important component of the U.S. domestic construction and forestry sector. They added that hand start engines can be equipped with an electric starter and should fall under this special provision as well and that the term "hand-startable" in regulations Section 1039.101(j) should be introduced consistently.

Letters:

Euromot, OAR-2003-0012-0822, 0823 p. 7-8

Yanmar commented that we should not impose a more stringent NMHC standard for engines below 56 kW.

Letters:
Yanmar, OAR-2003-0012-0615, 0813 p. 5

Our Response:

These comments are addressed in the preamble to this final rule (See Sections II.A.1.a). We have determined that the standards being adopted for engines under 75 horsepower are feasible and that they are the most stringent standards that are technologically feasible considering costs and other relevant factors. In making this determination, we considered the unique features of these engines. See also preamble Section II.B.4 and RIA Section 4.1.4 for more detailed discussions of this determination. Harmonization issues are discussed in preamble Section II.A.8, and issues relating to the appropriateness of the cutpoints established in the rule are discussed in preamble Section II.A.5.

3.1.4.3 Opposing PM Filter-Based Standards for <75 hp

What Commenters Said:

CNH commented that PM controls should not be imposed for engines under 75 hp since it is inconsistent with the Clean Air Act. They believe that smaller products will be the most difficult to design due to the compact product requirements and the comparatively large size of aftertreatment systems required and the need to locate the aftertreatment systems close to the exhaust manifold. Euromot commented that the need for active regenerating traps will lead to filter costs that are equivalent to the engine cost itself. They and the Association of Equipment Manufacturers requested that EPA not require PM filters on engines below 50 hp, or even 75 hp, subject to the Technology Review. Ingersoll-Rand commented that the 2013 standard misaligns EPA requirements for 25-50 hp engines with those proposed in Europe, leading to market disruptions and increased costs. I-R also expressed general concerns about cost impacts, performance and safety of the Tier 4 standards for these engines. The Association of Equipment Manufacturers requested that EPA delay the final decision on setting standards that require PM filters on engines below 50 hp pending the findings of the Technology Review.

In the proposal EPA analyzed a number of alternative scenarios, including Options 5a and 5b that involved no aftertreatment-based standards or no new standards at all for <75 hp engines. The Small Business Administration Office of Advocacy urged EPA to adopt either Option 5a or 5b in order to minimize burdens on small entities, pursuant to the RFA and the President's Executive Order 13272. Advocacy believes that a large number of small manufacturers of equipment will be negatively affected by aftertreatment requirements for engines below 75 horsepower. Also, Advocacy notes that EPA is within its statutory discretion in reducing emissions for engines above 75 horsepower alone. Advocacy believes that the information developed during the exhaustive SBAR Panel process supports the adoption of the least burdensome alternatives, Options 5a or 5b. Advocacy noted that these alternatives resulting from the SBAR Panel process described above would achieve essentially the same emissions reductions as EPA's proposed regulatory approach while imposing significantly less regulatory burden upon small entity equipment manufacturers. Advocacy recommended that EPA adopt Option 5a or 5b because: (1) the incremental benefits of requiring aftertreatment for smaller engines do not justify the large differences in cost, (2) EPA has not demonstrated the technical feasibility of aftertreatment technology for nonroad diesel engines below 75 hp, and (3) small entities will bear an unfair and disproportionate share of the economic costs associated with this rule.

Letters:
CNH Global, OAR-2003-0012-0819 p. 5
Euromot, OAR-2003-0012-0822, 0823 p. 6
Ingersoll-Rand, OAR-2003-0012-0504 p. 10
Association of Equipment Manufacturers, OAR-2003-0012-0669, 0670 p. 5
U.S. Small Business Administration Office of Advocacy, OAR-2003-0012-0815--0818, p. 10

Our Response:

As discussed in our responses to Issues 3.2.2.1 and 3.5.3, we continue to believe that aftertreatment-based PM standards are feasible for 25-75 hp engines with the lead time provided, and so are appropriate within the meaning of section 213(a)(4) of the Act. As set out in detail in RIA 4.1.4.3.2.1, there is no technical reason that the standards cannot be achieved. The ability of a PM filter to trap and eliminate nearly all of the soot PM in the exhaust is well established and is not a function of engine power. Due to their typically lower fuel efficiency, some smaller engines do have a somewhat higher production rate of sulfate PM, which is not well controlled by a PM filter. However, this is addressed through the virtual elimination of sulfur in diesel fuel and, for the small residual amounts of sulfur left in the fuel, through our setting a higher Tier 4 PM standard level for 25-75 hp engines compared to larger engines. We also explain in detail in the RIA how we expect these engines' exhaust temperature profile can be adapted to ensure regeneration of PM filters used by these engines, and our cost estimates include the cost of active regeneration systems for these engines to accomplish this. We also show that there are no significant issues regarding feasibility of equipment design or of safety for these engines. See, for example, Section II.B.1.b of the preamble. For additional responses to comments on technological feasibility, see Issues 3.1.4.2 and 3.5.3. The packaging issues raised by CNH are addressed in our response to Issue 3.2.1.2.

The comment from Euromot that the cost of a small engine filter system will be equivalent to the engine cost did not include any information on how this cost estimate was derived. SBA Office of Advocacy based their concerns about the costs involved with PM aftertreatment for 25-75 hp engines on two sources of cost information. The first is a study performed by VTT Processes for the European Union, which includes some very high estimated costs. As discussed in detail in our response to Issue 5.3.1.2, this study does not appear to be backed by factual information. It is noteworthy that no manufacturers who commented on our proposal chose to rely on this study in any way, though it has been widely available for over a year. The second source is EPA' s own cost estimates for these engines reported in the Draft RIA, which we are essentially confirming in the final RIA for this rule. We have factored these costs into our economic impact analysis for this rule; the results of this analysis do not indicate that we should drop the aftertreatment-based standards for engines under 75 hp. See Chapter 10 of the RIA for details.

The paramount objective of section 213 is to improve air quality by reducing pollutant emissions based on technological capability; all other enumerated factors, including cost considerations, are secondary. See Husqvarna AB v. EPA, 254 F. 3d 195, 200 (D.C. Cir. 2001) ("[t]he overriding goal of the section [213] is air quality, and the other listed consideration, while significant, are subordinate to that goal"). Here, PM aftertreatment-based reductions are technically feasible for 25-75 hp engines. The analyses we performed at proposal of options with reduced or no Tier 4 standards for engines under 75 hp estimate the net present value through 2030 of the lost benefits stream are very substantial, $70 billion and $43 billion for Options 5a and 5b, respectively. The corresponding cost savings through 2030 are far less– $3.8 billion and $2.6 billion, respectively. (See Table VI-1 at 68 FR 28462.) The final rule analyses of the emissions reductions and costs that form the bases for these numbers have not changed appreciably from the proposal analyses. (See RIA Chapters 3 and 6.) We note further that many of these smaller engines operate in populated areas and in equipment without closed cabs-- in mowers, small construction machines, and the like, where personal exposures to toxic emissions may be pronounced well beyond what is indicated simply by a comparison of nationwide emissions inventory estimates. (This point was made not only in written comments, but repeatedly in public hearing testimony.) We would also emphasize the remarkable growth in recent sales and usage for these smaller diesel machines, and we expect this trend to continue, pointing up the need for effective PM emissions control from these engines.

We have carefully considered costs for the engine standards as a whole and for engines in this power band. We have estimated the compliance costs for these engines (RIA Chapter 10 Table 10.3-13), the compliance costs for representative types of equipment using these engines (id. Table 10.3-14), and found no significant economic impacts on manufacturers of these engines, manufacturers of equipment using these engines, or end users of equipment using these engines (id. at Appendices A and B). This analysis, by itself, supports the reasonableness of the conclusion that aftertreatment-based PM standards are appropriate for these engines. Husqvarna, 254 F. 3d at 200 (section 213 does not mandate any specific method for considering costs).

EPA has also evaluated the cost-effectiveness of the engine standards as a whole, and determined that the dollar per ton of PM removed is reasonable, and well within the cost effectiveness range of other PM-control standards adopted by the Agency. See RIA chapter 8. This is also a permissible means of considering costs under section 213. Husqvarna, 254 F. 3d at 200.

SBA Office of Advocacy, however, maintains that the standards for this subset of engines are unreasonable viewed from the standpoint of cost effectiveness (cost per ton of the increment of PM removed by aftertreatment-based control). As noted above, we determined that the final standards are clearly cost effective. The commenter has not pointed to information showing that marginal cost effectiveness analysis is needed or appropriate because of any special or unique factors for this power category.

In any case, however, we provided such cost effectiveness analysis for this subset of engines at proposal, and found it to be reasonable. Adoption of Option 5a (no 2008 or 2013 PM standards for engines up to 75 hp) would result in foregone PM and NOx + NMHC reductions of 209, 000 and 334,000 tons respectively (much of the NOx + NMHC reduction being potentially carcinogenic or otherwise hazardous air toxics). Draft RIA Chapter 12 at pp. 79. We estimated the costs of this option as resulting in savings of $3.8 billion (both fuel and other operating costs and engine and equipment costs saved, id.). The incremental cost per ton of PM is $ 16,500; for NOx + NMHC it is $1,100. Id. at 80. These costs are well within the cost-effectiveness ranges found acceptable for these pollutants in other rules. See 68 FR at 28449 (Tables V.D.3 through V. D. 5). For option 5b (adopting the 2008 standards but no aftertreatment-based standards), the facts are much the same: foregone PM and NOx + NMHC emission reductions of 121,000 tons and 333, 000 tons, respectively, with a cost per ton of PM at $18,300 and $1,100 per ton, respectively, Draft RIA Chapter 12 at p.80, again, values easily within cost-effectiveness ranges for these pollutants already deemed reasonable. 68 FR at 28449. As noted above, monetized benefits of the PM standards for these engines exceed the costs by a factor of over 17-fold. EPA not surprisingly concluded at proposal that these options were not warranted. Draft RIA Chapter 12 at pp. 103-104.[14]

These aftertreatment-based standards achieve important emissions reductions and public health and welfare benefits. They are technically feasible, the benefits of the standards significantly outweigh the costs, the overall set of standards are cost effective, the economic impact analysis indicates there will not be a significant adverse economic impact on either engine or equipment manufacturers in this power category, and, even if we considered cost effectiveness for just these engines, the standards remain appropriate. The body of evidence here thus clearly indicates that it is appropriate to adopt aftertreatment-based PM standards for this power category (and indeed, strongly indicates that to do otherwise would be inappropriate, within the meaning of CAA section 213 (a)(4)).

The impact of new emissions standards on small entities was the subject of the analysis carried out by the government SBAR panel under the requirements of SBREFA as part of this rulemaking. The panel report included a number of recommendations to help small businesses, and these were subsequently incorporated into the proposal and are being adopted in this final rule. In conducting the SBREFA analysis, we observed that equipment manufacturers who are small entities are not disproportionately focused in the under 75 hp market, but rather participate in a wide diversity of nonroad applications, using engines large and small, and their issues are not restricted to the under 75 hp category. Therefore, we believe it is more appropriate to address issues unique to small equipment manufacturers in this category through the set of special flexibility measures that apply to the wide spectrum of horsepower sizes.

SBA Office of Advocacy recommends setting a less stringent standard for all engines and equipment in the power category, whether produced by small or large manufacturers in a situation where the vast majority of engines and equipment in this power category are produced by large and not small manufacturers. EPA's equipment manufacturer flexibility program contains provisions specifically tailored to help small manufacturers, and avoids the loss of important public health and welfare benefits that SBA Office of Advocacy's overbroad approach would entail.

Finally, although it is appropriate to set these Tier 4 standards in this rule, we recognize that there is much development work ahead for manufacturers over the next nine years before these standards take effect. We discussed in the proposal, and are reiterating in this final rule, our plans to conduct a technology review in 2007 to examine these issues again in the light of progress made between now and then. As discussed in Section VIII.A of the preamble, this review for engines under 75 hp will be a comprehensive undertaking that may result in adjustments to standards, implementation dates, or other provisions (such as flexibilities) in either direction (that is, toward more or less stringency), depending on conclusions reached in the review about appropriate standards under the Clean Air Act. All relevant

[14] Given that all of this analysis appears at length in the record to the proposed rule, EPA does not agree with the commenter's assertion that EPA failed to provide the means to analyze this option.

factors including technical feasibility and commercial viability of engines and machines designed to meet the standards will be taken into account.

3.1.4.4 Options for 25-50 hp

What Commenters Said:

The Small Business Administration Office of Advocacy commented during the interagency review process that EPA should not adopt an aftertreatment-based standard for PM for 25-50 hp engines.

Our Response:

Our comments to this option are much the same as to the same commenter's request not to apply aftertreatment-based PM standards to engines in the entire 25-75 hp power category. As described in Sections II.A and II.B of the preamble, we continue to believe that the application of PM filters to small engines is both feasible and is an important element of our efforts to address air quality concerns associated with nonroad engines. As a courtesy, we nonetheless evaluated a new Option 5c in which the trap-based PM standard and the Tier 4 NOx standard would not be applied to 25 - 50 hp engines, but would continue to apply to above 50 hp engines. See generally, RIA chapter 12.2.2.2.

The concern was raised that small businesses in this power grouping will face a greater relative burden in designing equipment for engines with aftertreatment, and that they may need additional lead time beyond that provided by the small volume allowances. EPA believes that in general the small volume allowances should provide reasonable lead time opportunity for these manufacturers, but recognizes that there may be individual cases where more lead time would be appropriate for small business manufacturers in this power category. EPA is therefore adopting a technical hardship provision similar to that adopted for the percent of production allowance. Small business manufacturers using engines in the 25-50 hp range could petition EPA to approve additional needed lead time in appropriate, individualized circumstances, based on a showing of extreme technical or engineering hardship as provided in 40 CFR 1039.625(m). EPA could approve additional small volume allowances, up to a total number of 1100 units. This total number includes the allowances that are already available under the rule without request. These additional allowances could only be used for engines in the 25-50 horsepower range, and could only be approved for qualifying small business equipment manufacturers. The additional allowances would not be subject to the annual limits noted earlier but they could only be used after the maximum amount of the standard allowances are used.

EPA recognizes that it is important to facilitate the process for small business equipment manufacturers to seek such approval, and intends to work with small manufacturers so that any transaction costs for them or for EPA can be minimized. For example, EPA could consider at one time a common request from similarly situated small business equipment manufacturers, as long as all of the necessary individual information for each applicant were provided.

<u>Emission Inventory Impacts</u>

Option 5c is identical to our final program, except that it would not require 25-50hp engines to meet the trap-based PM standards that are in our final program, nor would it require these engines to meet the Tier 4 NOx standards. As a result, the PM and NOx emission reductions for Option 5c would be lower than those for our final program. Moreover, pollutants other than PM and NOx would also be affected under this option. For instance, the reductions in non-methane hydrocarbons (i.e. air toxics, many of which are carcinogenic) and CO that will occur for our final program are generated primarily through the presence of catalyzed diesel particulate traps, so the removal of the trap-based PM standards for 25-50 hp engines will also produce a corresponding reduction in the air toxics and CO benefits.

In evaluating the inventory impacts of Option 5c, we assumed that the 2008 PM standards for 25-50 hp engines were met using a steady-state test cycle for both our final program and Option 5c. Whether these engines should be required to meet standards under a transient test procedure is a separate issue from the use of aftertreatment. Our analysis was designed to focus on the impacts of foregoing the use of aftertreatment.

Option 5c produces fewer benefits for all pollutants starting in 2013 in comparison to our final program. RIA Table 12.2.2.2.1-1 (reprinted below) shows the net impact of Option 5c on the 30-year net present value inventory estimates.

50-State 30-Year Net Present Value Emission Increases
For Option 5c In Comparison to Final Program (tons)

	3% discount rate	7% discount rate
PM	56,833	25,238
NOx + NMHC	381,459	170,819

EPA regards these foregone benefits as highly significant, especially given that they are readily achievable at reasonable cost.

<u>Cost Analysis</u>

Option 5c would reduce the overall costs of the program since 25-50 hp engines would not need to install PM traps nor make engine modifications to comply with more stringent NOx standards. We calculated the total nationwide cost savings by summing the per-engine savings across all engines for each year starting in 2013. RIA Table 12.2.2.2.2-1, reprinted below, shows the resulting 30-year net present value cost savings for Option 5c.

50-State 30-Year Net Present Value Cost Savings
For Option 5c In Comparison to Final Program ($million)

	3% discount rate	7% discount rate
All pollutants	2,041	997
PM	1,514	735
NOx + NMHC	527	263

Benefits Comparison

We were able to estimate the benefits of Option 5c using the benefit-transfer methodology developed in Chapter 9 for estimating the monetized benefits of the final program. Accounting for the reduction in monetized health and welfare benefits from the net emission inventory impacts of Option 5c in comparison to our final program produces 30-year net present value of loss in benefits of $36.6 billion at a 3 percent discount rate, and $14.8 billion at a 7 percent discount rate. This loss in benefits is much larger than the costs savings associated with not applying trap-based PM standards to 25-50-hp engines as shown above, highlighting the fact that there is a substantial net benefit to society of applying the trap-based PM standards to 25-50 hp engines. These calculations, furthermore, do not estimate benefits of emission reductions of NOx or air toxics (i.e. NMHC). These benefits, though not quantified here, are significant, especially considering the large numbers of these 25-50 hp engines and the fact that they are often used in populated areas and in equipment without closed cabs. See Draft RIA 12.6.2.2.9 where we voiced similar concerns regarding forgoing trap-based PM controls for 50-75 hp engines.

Costs Per Ton

The cost-effectiveness of the final standards for 25-50 hp engines can be calculated from the values in RIA Tables 12.2.2.2.1-1 and 12.2.2.2.2-1, and are summarized here.

50-State 30-Year Net Present Value Cost-Effectiveness
For Option 5c In Comparison to Final Program ($/ton)

	3% discount rate	7% discount rate
PM	26,600	29,100
NOx + NMHC	1,400	1,500

These cost-effectiveness values remain within the ranges that EPA has traditionally accepted as reasonable. See 68 FR at 28449, Tables V.D.3 to V. D. 5.

Summary: The aftertreatment-based standards for PM for these engines are feasible at reasonable cost. Monetized benefits for PM reductions alone exceed the costs of aftertreatment-based PM controls for these engines by well over an order of magnitude. Benefits of air toxics reductions resulting from use of PM-traps are also substantial. For these reasons, EPA sees no basis in law or in policy for adopting this option.

3.1.4.5 Options for 50-75 hp

What Commenters Said:

Caterpillar and John Deere commented that the proposed optional program for engine from 50 to 75 hp (37 -56 kW) undermines the integrity of the rulemaking process. They stated that the modification to the previously promulgated Tier 3 requirements for the 37 to 56 kW category represented by the optional program does not respect the basic need to provide certainty of investment associated with promulgated future standards. Even though the Tier 3 requirements for this category of engines do not become effective until 2008, there needs to be recognition that engines in the category form part of an integrated product range and are derived from an engine platform covering a much wider power range. For Caterpillar, the 1 litre/cyl. platform will be used for products in this category but will also be the basis for derivatives with power outputs of greater than 130 kW. The basic product architecture decisions for the platform had already been confirmed on the basis of the promulgated Tier 3 provisions before the issue of the proposed rule. The argument that manufacturers have a choice does not acknowledge that ultimately the market will make the choice and manufacturers will need to respond to the needs of the market. One commenter (Deere) noted that in addition to these concerns, the NO_x-PM tradeoff at the lower PM standard could require the use of cooled EGR whereas the original standard may not, and recommends that EPA maintain the original Tier 3 PM standard of 0.40 g/kW-hr for 2008.

Caterpillar believes that the 37 to 56 kW Tier 3 option could potentially disrupt New Product Introduction programs that are already in progress and undermines the imperative to maintain US/EU harmonization for nonroad engine emissions standards. They stated that the EU legislative structure does not provide an appropriate mechanism for such an optional program and it is improbable that the EU legislators would support the logic of the program. Further, Euromot stated that this approach corrupts EPA/EU harmonization already achieved for this power category and potentially undermines manufacturers' product plans that were predicated on the already promulgated and reconfirmed Tier 3 requirements by EPA in October 2001 that would be modified by the option program.

Caterpillar also commented that the Tier 3 option raises concerns regarding the lack of appropriate controls to prevent OEMs from changing engine suppliers in order to benefit from potentially lower cost Option A engines until the validity period expires, and then adopting Option B engines for a period before the mandatory introduction of Tier 4. They believe the approach of linking the Tier 4 requirements with the Tier 3 optional selection has the effect of structurally locking out an engine manufacturer from a significant portion of the Tier 4 market. Caterpillar believes that the optional program represents an anti-competitive measure since it will restrict the OEMs' choice of the Tier 4 engine suppliers and should be eliminated from the proposed rule.

Cummins commented that regardless of the optional PM standard in 2008 for engines in the 37 to 56 kW category, the 2012 implementation date for the second option is unacceptable in terms of the phase-in of power categories. A reasonable phase-in period is required to manage engineering resources. This is an issue not only for engine manufacturers but also for nonroad equipment manufacturers with the large numbers of applications in this power range. The Tier 4 proposal drastically reduces the power category phase-in provided to manufacturers. The optional PM standard for 2008 should be omitted from the proposal and the implementation date for aftertreatment forcing standards should be 2013.

Letters:
Caterpillar, Inc., OAR-2003-0012-0812 p. 3-4
Euromot, OAR-2003-0012-0822, 0823 p. 2-3
Deere & Company, OAR-2003-0012-0692 p. 4-5
Cummins, Inc., OAR-2003-0012-0650 p. 8

Our Response:

These comments are addressed in the preamble to this final rule (see Sections II.A.1.a and

II.A.3.b), where we explain why we are keeping the two options approach for 50-75 hp engines. We do not believe that providing two options for manufacturers, one of which is essentially aligned with the EU program, disharmonizes emission standards. See preamble Section II.A.8. Manufacturers for whom the paramount goal is to produce a single engine design meeting like standards in both markets can do so by choosing the aligned standards option. Deere's concern is addressed in Section 4.1.5 of the RIA, where we show that the combination of the lower sulfur certification test fuel and the addition of a diesel oxidation catalyst would reduce PM emissions sufficiently to meet the 2008 standard, without a need to work an engine's NOx-PM tradeoff for PM reductions at the expense of NOx. In fact, the oxidation catalyst would reduce NMHC emissions, thus providing additional margin under the NMHC+NOx standard for NOx emissions.

3.1.4.6 CO Standards

What Commenters Said:

Euromot commented that the proposed CO limit for engines below 8 kW is too stringent. They stated that CO emissions rise when retarded injection timing is used to reduce NO_x emissions, and oxidation catalysts are necessary for small engines to meet the standard. However, the use of this technology increases the price of such engines considerably and could result in their disappearance from the market. Euromot believes that we should finalize a CO limit of 7.5 g/kWh instead of 6.5 g/kWh for engines with a power less than 8 kW.

Similarly, Yanmar commented that we should maintain the Tier 2 CO standard for engines below 8 kW, and that we should not reduce the standard for these engines to 6.6 g/kWh. They added that SI engines comprise a majority of engines in this category and CI engines already have a much lower standard and sales volume than SI engines, and as a result there is no reason to impose this more stringent standard that would be costly and would provide very little environmental benefit. Yanmar provided additional discussion and data to support their position on this issue in its public comments.

<u>Letters:</u>
Euromot, OAR-2003-0012-0822, 0823 p. 7-8
Yanmar, OAR-2003-0012-0615, 0813 p. 5

Our Response:

We proposed the changes in CO standards solely for the purpose of helping to consolidate power categories. We stated in the proposal that we were not exercising our authority to revise the CO standard for the purpose of improving air quality, but rather for purposes of administrative efficiency. Because we proposed the CO standard changes for the sake of simplifying and consolidating power categories and not because of any technical considerations relating to emission reductions, we do not believe it productive to take issue with the manufacturers' views that these proposed changes raise serious feasibility concerns. We instead are withdrawing this aspect of the proposal, the result being that the existing CO standards remain in place. In doing so, we are not considering or reexamining (and at proposal did not consider or reexamine) the substantive basis for the level of those standards. See Issue 3.1.1.1.4 for our response regarding application of new test cycles to CO standards.

3.1.5 Power Categories

3.1.5.1 Selection of Power Categories

What Commenters Said:

EMA expressed support for the new Tier 4 75 hp (56 kW) cutpoint, but commented that we should consider additional factors in the process of establishing the number of power categories and corresponding cutpoints. In establishing the 56 kW cutpoint, and in reducing the number of power categories from nine categories down to five, they believe that we only took into consideration one of the various factors that impact the establishment of power categories (i.e. the transferability of on-highway-like technologies). EMA suggested that we should also examine the workload, the need for manufacturers to spread out the workload, the number of engine families and equipment applications, and the natural breakpoint for engine platforms that can be categorized in more than one power category. In setting the nonroad engine standards and power categories, the difficulty, costs, and technical hurdles associated with technology transfer between different engine applications should be carefully assessed. Transfers of technology require significant investments of manpower and capital and often also require manufacturers to overcome complex technological and design hurdles.

EMA stated that the 37 to 130 kW power range is an especially challenging group of products since this range encompasses a very large number of engine families and an even larger number of applications. They believe that the proposal would require all engines and applications within the 37 to 130 kW power range to meet the new standards in 2012, and even though the rule provides for delayed compliance for engines from 37 to 56 kW, this comes at a very high penalty (i.e. the need to pull ahead low PM technology in 2008 which requires manufacturers to revamp Tier 3 products late in the planning process). Engine platforms that will be redesigned in 2012 for the low end of the 56 to 130 kW power category, are also used in the 37 to 56 kW category. EMA believes that it is not feasible or practical to spread the engineering and design work on the same engine platform used in two power categories. By necessity, some engine platforms in the 37 to 56 kW category will have to be redesigned in the 2012 time frame under EPA's proposal. To better deal with the workload issues, EMA suggested that we either allow equipment flexibility credits to be exchanged between the power categories involved with the 37-130 kW (50-175 hp) range, or create more power categories and further stagger the workload burden.

Ingersoll-Rand commented that by basing the standards on engine power rating, we blurred very significant technical and economic distinctions between diverse equipment designs. They offered the example of a Bobcat skid-steer loader and a Thermo King refrigeration unit which might employ engines within the same power rating, but the engines would be used under vastly different operating conditions. As a result, they believe, the Tier 4 rule appears to be inconsistent with the CAA, which requires emission standards be established for individual classes and categories of nonroad engines and vehicles.

Further, Ingersoll-Rand added, consolidation of all equipment models rated between 175 and 750 hp from three power categories into one fails to take into account the diversity of nonroad applications across this expansive power band. They believe it also creates significant hardship by requiring the introduction of aftertreatment technologies in a single year when PM and NO_x standards take effect in 2011. In contrast, introduction of Tier 2 standards for the same power band occurred over a three year period. Ingersoll-Rand believes that consolidation of power categories will result in transition difficulties and demands on the resources of equipment manufacturers, thus necessitating a greater degree of flexibility than what was offered in the NPRM.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 10-11
Ingersoll-Rand, OAR-2003-0012-0504 p. 3-4, 13

Our Response:

Section II.A.5 of the preamble to this final rule includes a detailed response to comments objecting to the power categories we are adopting. Regarding EMA's comment about adequate time for technology transfer to smaller engines, our Tier 4 standards provide for 25-75 hp engines to achieve PM filter-based standards in 2013, one year after new standards take effect for 75-175 hp engines. As discussed in Section II.A of the preamble to this final rule, we believe this and other phase-in and flexibility provisions provide an adequate opportunity for manufacturers to transfer technology from larger engines and spread the redesign workload. We disagree with EMA's contention that the 2013 Tier 4 date for 25-75 hp engines is not real because it entails also meeting the new PM standard for 50-75 hp engines in 2008, and this latter requirement comes at too high a penalty. We believe that the 2008/2013 compliance path is feasible, as explained in Section II.A.1.a of the preamble to this final rule. We do not believe that creating additional power categories and flexibility provisions to deal with EMA's concerns are warranted, given that the standards we are adopting, without such additional flexibilities, are already feasible and appropriate.

EMA's comment about allowing equipment manufacturer credits to be transferred between power categories is addressed in our response to Issue 9.2.1.5. In response to EMA's alternative suggestion for dealing with the redesign workload burden (creating more power categories), we have dealt with these workload concerns by providing substantial implementation flexibility and by staggering start years for the categories we have created, and thus we believe that creating additional power categories is not necessary.

Regarding Ingersoll-Rand's comment about the need to set standards based on factors other than power rating, such as the diversity of operating conditions, we believe that varying standards by the engines's expected operating conditions or similar parameters would create an unwieldy system of standards, in which engine manufacturers would face large uncertainty about what standards they must design their engines to. Power rating, explicitly defined, is readily and unambiguously identifiable for an engine, and has been used as the primary delimiter in standards-setting for Tiers 1, 2 and 3. We believe it is the appropriate delimiter for Tier 4 as well. The diversity of operating conditions experienced in use by engines in these power categories is taken into account in our feasibility assessment in Chapter 4 of the RIA. In addition, we note that we have made special provisions to allow the testing of engines that operate on restricted operating cycles, such as constant speed engines and refrigeration units (the application that Ingersoll-Rand specifically identified).

3.1.5.2 Proposed 75 hp Cutpoint for Emission Control Technology

What Commenters Said:

EMA, Euromot, Lister-Petter, and Yanmar expressed support for the 75 hp (56 kW) cutpoint, arguing that it best defines the demarcation between those engines related to on-highway engines and the simpler, low cost nonroad engines under 56 kW. (See additional discussion under Issues 3.2.1 and 3.1.4).

ARTBA, AEM, and Ingersoll-Rand commented that our proposed reclassification of engine power categories does not correctly reflect the cutpoint in emission control technology. They stated that setting "highway-like" categories is not always appropriate since many nonroad engine manufacturers have no on-road product presence. A precedent has already been set with the Tier 1 through 3 regulations that already established the power ranges from 50 to 100 hp and 100 to 175 hp as separate power categories for regulation. In addition, Europe and Japan have also aligned with this convention that will now be upset by the sudden switch to 75 hp as the new cutpoint. They stated that many nonroad equipment manufacturers disagree with the assumption that nonroad engines will display similar characteristics to their on-highway counterpart of similar displacement per cylinder, and have indicated that the similarities to on-highway diesel engines do not begin to uniformly appear until a higher power level. AEM provided additional discussion on this issue noting that equipment manufacturers see their greatest difficulty in producing Tier 4 complying machines in the 75 to 100 hp (56 to 75 kW) range and some predict a sharp decline in sales within this power category due to the Tier 4 standards.

These commenters believe that we should establish the power categories based on a 100 hp (75 kW) cutpoint, since this is the point above and below which the highway derived nonroad engine families do and do not exist, respectively. They stated that we should also reconsider the proposed standards in the context of the power cutpoint as well. They believe that adopting this strategy would help resolve some major concerns with the emission control technology and offer five points to support their belief. First, there is a technology development gap for emission control systems designed for nonroad engines less than 100 hp because there is no direct surrogate in the on-highway market. Second, NO_x adsorbers and PM traps need to be introduced into the on-highway market by 2007, which will limit the resources of engine manufacturers and emission control suppliers, thus compromising the effort to comply with the Tier 4 nonroad standards. The nonroad industry has experienced this diversion of R&D resources with the recent implementation of Tier 2 amidst the pull-ahead of on-highway controls caused by the consent decree. Third, the proposed 75 hp cutpoint is inconsistent with Tiers 1 through 3. Fourth, the large cost increase associated with Tier 4 compliance will be more easily absorbed by the larger equipment types. Fifth, there are more engines within the 50 to 100 hp category that share a common machine platform than for the 75 to 175 hp category, and as a result, the industry would benefit from a 100 hp cutpoint by spreading the costs of redesign over a larger volume of machines.

<u>Letters:</u>
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 10-11
Euromot (IV-D-489) p. 4
Lister Petter, OAR-2003-0012-0155 p. 1
Yanmar, OAR-2003-0012-0615, 0813 p. 5
American Road and Transportation Builders Association, OAR-2003-0012-0633 p. 2
Association of Equipment Manufacturers, OAR-2003-0012-0669, 0670 p. 9-10
Ingersoll-Rand, OAR-2003-0012-0504 p. 11-12

Our Response:

Section II.A.5 of the preamble to this final rule includes a detailed response to these comments.

3.2 Technical Feasibility of Engine Standards

3.2.1 General Comments

3.2.1.1 Standards are Feasible

What Commenters Said:

A number of commenters believe that the standards are feasible provided 15 ppm sulfur fuel is available. They stated that the required emissions control technologies have been and can be integrated into a variety of nonroad applications. The use of exhaust emission control technology for nonroad diesel engines is not new. For over 35 years, nonroad diesel engines used in the construction and mining industries have been equipped with exhaust emission control technology. The diesel oxidation catalyst and the diesel particulate filter has been installed on nonroad engines both as original equipment and as retrofit technology on over 250,000 nonroad engines. These technologies have been and can be integrated in nonroad vehicles and equipment. The technologies can fit in the available space, can be located in a way that enables the control device to function effectively, and can be operated on a variety of nonroad engine applications and operating environments. For example, technology such as Johnson Matthey's already commercially available CRT particulate filter are being combined with NO_x control strategies such as EGR, lean NO_x catalysts, SCR and NO_x adsorber technology. These are being integrated into engine packages that have also seen dramatic advances in both physical design and operating parameters. Several commenters argued that the proposed standards are feasible within the proposed time frame and can be met cost effectively. One commenter (MECA) provided additional discussion on this issue and cited to a comprehensive list of references discussing the considerable progress in developing, optimizing, and applying advanced emission control technologies and strategies for reducing emissions from diesel engines as included in Diesel Emission Control: 2001 in Review, SAE Paper No. 2002-01-0285 (2002 SAE Congress, Detroit) and Diesel Emission Control: 2002 in Review, SAE Paper No. 2003-01-0039 (2003 SAE Congress, Detroit). This commenter also cited to (and provides a copy of) their document entitled Exhaust Emission Controls Available to Reduce Emissions from Nonroad Diesel Engines, which includes a more detailed discussion of the emission control technologies for nonroad diesel engines, operating experience, and application considerations. Another commenter (UCS) cited to their recently published report "Cleaning Up Diesel Pollution; Emissions from Off-Highway Engines by State," which showed that pollution controls under development for highway trucks and buses can be cost-effectively applied to nonroad engines as well.

Letters:
3M Company (IV-D-765) p. C290
Building and Construction Trades Dept., AFL-CIO, OAR-2003-0012-0674 - 0676 p. 3-4
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 2, 5-6
NESCAUM, OAR-2003-0012-0659 p. 5-6
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 9
Union of Concerned Scientists, OAR-2003-0012-0830 p. 1
New York Public Hearing, A-2001-28, IV-D-05 [MECA p. 116]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [JM p. 105; MECA p. 58]
Chicago Public Hearing, A-2001-28, IV-D-06 [JM p. 160-163; MECA p. 46]

The technologies necessary to implement EPA's proposal are available. In particular, PM trap technology is available now and should be easily transferred to nonroad engines. NO_x adsorbers and other NO_x control technologies also are expected to be available and transferrable to nonroad sources.

Letters:
Clean Air Task Force, et. al., OAR-2003-0012-0508 p. 9-10
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 9
New York Public Hearing, A-2001-28, IV-D-05 [Engelhard p. 203]
Chicago Public Hearing, A-2001-28, IV-D-06 [CATF p. 256; SACE p. 181-183]

Some of the emission reduction technologies have already been demonstrated for nonroad engines. Commenter cited to the program in the Boston area as an excellent example of how these technologies can be applied to the nonroad sector, but does not provide any additional details on this program.

Letters:
Los Angeles Public Hearing, A-2001-28, IV-D-07 [CCA p. 145]

The proposed nonroad standards are realistic and attainable, especially given the long time frame, provided 15 ppm sulfur diesel is available. The emission controls industry is currently working to ensure that the technology is available to meet the standards.

Letters:
New York Public Hearing, A-2001-28, IV-D-05 [Corning p. 146]

EPA's proposed standards are feasible and the technologies that are necessary to meet the standards will be available prior to the proposed compliance deadlines. Section 213(a)(3) and (b) of the CAA directs EPA to establish nonroad standards that provide the greatest degree of emission reduction achievable at the earliest possible date. Section 213 mandates a technology forcing standard, which is supported by case law (see Husqvarna AB, et al. v. EPA, 254 F.3d 195, 201 (D.C. Cir. 2001) and National Petrochemical & Refiners Ass'n. v. EPA, 287 F.3d 1130 (D.C. Cir. 2002)). With respect to NO_x emissions, it is expected that NO_x adsorbers will be available to meet the standards within the proposed time frame. With respect to PM emissions, catalyzed diesel particulate trap (CDPF) technology can reduce these emission in modern diesel engines burning ultra-low sulfur fuel by over 90 percent. The commenter (CATF) provided additional discussion on this issue, notes that this technology is available and allows for the PM Tier 4 standards to be met today and asserts that even though the nonroad rule complies with the mandate in Section 213 in many respects, some improvements will be necessary to ensure that the stringency and timeline of the standards meet the requirements of this section. (See additional discussion under Issues 3.1.1 and 3.1.4).

Letters:
Clean Air Task Force, et. al., OAR-2003-0012-0508 p. 8-10

The nature of nonroad equipment use generally renders such changes less burdensome than is the case in the highway sector. Nonroad equipment is usually less sensitive to repackaging issues so long as overall functionality is maintained. Also the likelihood that consistent and effective maintenance will be available to support any implemented emissions control strategy is greater in the nonroad sector given the more centralized fleet nature of many nonroad equipment applications. For example, SCR might be more widely acceptable since urea refueling could be more readily incorporated into a fleet-type refueling structure. Also, CDPF maintenance could be performed as an integral component of existing fleet maintenance practices. The potential for redesign acceptance and effectiveness is much greater in the nonroad sector and the standards and compliance deadlines should be established accordingly.

Letters:
Clean Air Task Force, et. al., OAR-2003-0012-0508 p. 10

Further, MECA commented that the emission control technology industry will be able to provide the support necessary for implementation of the proposed standards and the industry will have the capacity to engineer prototypes, provide technical assistance, and manufacture the needed products in adequate quantities to meet the engineering and production schedules of the engine and equipment manufacturers over the full range of engine applications covered by EPA's proposed rule. MECA member companies plan to spend over $1.5 billion to develop and manufacture emission control technologies for diesel engines, much of which will be targeted at increasing the manufacturing capacity to meet the anticipated demand. The number of companies developing and manufacturing emission control technologies for diesel engines continues to grow and EPA's standards will further facilitate efforts to meet product demands.

Letters:
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 6-7

Our Response:

We agree with the commenters in general that advanced emission control technologies, especially PM filter based technologies, can be applied to a wide range of nonroad diesel engines provided clean 15 ppm sulfur diesel fuel is used. We appreciate the additional data and information provided by the commenters that further informs the decisions taken in this action. As described in section II of the preamble, we have made some changes from the proposed program to address relatively specific issues related to certain horsepower categories. Those modifications do not change our overall conclusion that advanced NOx and PM emission controls enabled by clean diesel fuel can be applied to a broad range of nonroad diesel engines as reflected in these comments.

3.2.1.2 Standards May Not Be Feasible/Uncertainty in Emissions Control Technology

What Commenters Said:

A number of commenters also believe that the standards may not be feasible since it is uncertain whether the required emissions control technologies will function reliably in all types of nonroad applications. These commenters believe that space limitations in the nonroad engine, the burden on equipment manufacturers to redesign and manufacture machines with particulate filters and NO_x adsorbers will be substantial. The addition of these devices will require a reconfiguration of the entire equipment envelope to accommodate an enlarged engine package. This can be extremely difficult in smaller machines, such as Bobcat skid steer loaders and mini-excavators, where compartment space is limited. EPA's proposed rule will require significant internal changes, compromising safety and function. One commenter (AGCA) added that equipment designs must comply with OSHA and other worksite safety standards for visibility, rollover protection, stability, engine lockouts, and other requirements and that EPA must include all of these considerations in its deliberations, allowing for sufficient time for redesign, manufacture, and approvals.

Letters:
Associated General Contractors of America, OAR-2003-0012-0791 p. 9
CEMA-CECE, OAR-2003-0012-0598 p. 2
Ingersoll-Rand, OAR-2003-0012-0504 p. 8
Yanmar, OAR-2003-0012-0615, 0813 p. 2-3
New York Public Hearing, A-2001-28, IV-D-05 [EMA p. 102; IR p. 225]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [EMA p. 152]
Chicago Public Hearing, A-2001-28, IV-D-06 [EMA p. 27]

Unlike highway engines, nonroad engines are produced in a much wider power range, from less than 8 hp to over 3,000 hp. These engines are used in a larger number of specialized applications. Nonroad engines are installed in over 6,000 different types of machinery and equipment, which are designed to carry out a variety of functions. The nonroad equipment operators' situations can vary greatly including the need for multiple duty cycles, the capability to operate in harsh environments and the need for high reliability and durability. The aspiration system for small nonroad engines below 56 kW is mainly naturally aspirated instead of turbo-charged and air cooled like highway engines. For nonroad machines that operate at very low ground speeds or are stationary, there is no "ram air" effect to aid cooling systems, as in highway engines, so additional power is often needed to operate the cooling fan. As a result, reducing NO_x becomes more complicated. In addition, when emission control technology is scaled upward to a higher power category, the technology does not always grow on a linear scale. The demands on emission-control technologies in higher horsepower applications can increase exponentially leading to larger, heavier emission control devices. Therefore, applying highway technologies to nonroad engines could be very costly, resulting in machines that cost more than the consumer is willing to pay. The commenters provided additional discussion regarding the difficulty of transferring emission reduction technologies to the nonroad engine (see related discussion below on the technical feasibility of PM and NO_x control technologies). One commenter (AGCA) added that the number of nonroad diesel engine types is much higher than the highway sector, with more than 1,700 equipment manufacturers involved, and that because of the diversity in the marketplace, it is possible that each specific engine could require a complex redesign for each equipment application. Another commenter (Yanmar) provided additional information on their products to illustrate the diversity of nonroad engines and the potential challenges associated with the transfer of highway technology.

Letters:
Associated General Contractors of America, OAR-2003-0012-0791 p. 9
CEMA-CECE, OAR-2003-0012-0598 p. 2
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 11-14
Far West Equipment Dealers Association, OAR-2003-0012-0679 p. 3-4
Ingersoll-Rand, OAR-2003-0012-0504 p. 6-9
North American Equipment Dealers Association, OAR-2003-0012-0647 p. 3-4
Ohio-Michigan Equipment Dealers Association, OAR-2003-0012-0747 p. 3-4
USA Rice Federation, OAR-2003-0012-0652 p. 3-4
Yanmar, OAR-2003-0012-0615, 0813 p. 2-3
New York Public Hearing, A-2001-28, IV-D-05 [EMA p. 103]

Los Angeles Public Hearing, A-2001-28, IV-D-07 [EMA p. 152]
Chicago Public Hearing, A-2001-28, IV-D-06 [AEM p. 222; EMA p. 27]

Some nonroad engines may operate in low load applications that do not provide high enough exhaust gas temperatures to enable the use of on-highway aftertreatment devices that depend on the availability of high temperature exhaust gas for efficient operation and regeneration, while others may operate at high load where the application of EGR technology may overtax already limited vehicle cooling systems. In many cases, the nonroad engine must be designed to accommodate both types of operation, which results in design constraints for the application of emission control technologies.

Letters:
CEMA-CECE, OAR-2003-0012-0598 p. 2
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 14
Yanmar, OAR-2003-0012-0615, 0813 p. 2-3

EPA has not fully addressed the issue of whether aftertreatment devices on smaller engines and equipment such as lawn and garden equipment can operate reliably in an environment that involves severe vibration, tight heat, height and space constraints, and operation in and around flammable debris. The heat generated by aftertreatment devices may conflict with the stringent product safety requirements that lawn and garden equipment must comply during and immediately after use. Even though mining equipment operating in flammable coal dust situations have been proven safe, this does not address the potential problem with high temperatures from PM filters that can burn operators, ignite debris, or simply violate consumer product safety requirements.

Letters:
U.S. Small Business Administration Office of Advocacy, OAR-2003-0012-0815 - 0818 p. 8

EPA should not require further reductions in nonroad diesel engine emissions unless it is demonstrated that the necessary technology and accompanying low-sulfur fuel are available and will work effectively in all nonroad applications. Emission control devices should be available in nonroad engine markets several years prior to implementation of a new standard for nonroad engines.

Letters:
Associated General Contractors of America, OAR-2003-0012-0791 p. 5

Diesel particulate filters (DPFs) and DOCs often necessitate a narrow temperature window to ensure maximum efficiency, which often cannot be ensured in conditions associated with construction applications. Similarly, NO_x adsorbers have both high and low temperature requirements, with efficiency decreasing with lower temperatures. This strategy can also require optimal tuning and a restricted range of power output that can be exacerbated by the type of use and site conditions. Given these concerns, many highway applications may not be suitable for nonroad engines.

Letters:
Associated General Contractors of America, OAR-2003-0012-0791 p. 7-8

Our Response:

As we described extensively in the draft RIA at proposal, we agree with commenters that nonroad diesel equipment is diverse spanning a wide range of engine sizes and equipment types and uses. Further, we agree that the Tier 4 program must consider these differences in setting both the stringency of the emissions standards and the implementation date and schedules for those standards. Our Tier 4 proposal specifically addressed a number of these issues in the proposed emission standards and the timing for those proposed standards. Based in part on the information provided in these comments and our own continuing technical analysis for nonroad equipment, we have modified the Tier 4 program from proposal in further consideration of unique nonroad issues. Yet in general, the overwhelming evidence documented in the RIA, preamble, and the numerous comments supporting the program show that advanced emission control technologies can be applied to nonroad diesel engines when enabled by clean 15 ppm sulfur diesel fuel.

We appreciate comments noting that nonroad equipment using Tier 4 diesel engines will require redesign in order to accommodate the new emission control technologies. We agree that such modifications will be necessary and we gave specific consideration to the time required to complete these redesigns and the cost of the redesigns in our proposal. We have accounted for the engineering (design) and hardware (variable) costs for nonroad equipment redesign to accommodate Tier 4 emission control technologies in Chapter 6 of the draft RIA for the NPRM, and we have updated that analysis in this final rule.

We disagree however, with the implication that the redesign efforts will in some way compromise safety (including visibility, rollover protection, stability, engine lockout, etc.) or function. These technologies have already been applied in automotive applications and in nonroad equipment used in mining and other applications where OSHA or other safety requirements must be met. The design tools and engineering challenges to safely apply these new technologies are similar in scope and complexity to existing engineering challenges to install other exhaust components such as exhaust mufflers. As described in Chapter 4 of the RIA (and Chapter 4 of the draft RIA), these technologies have already been successfully applied to some nonroad applications where particular safety issues must be considered. See, e.g RIA 4.1.3.2; see also preamble section II.B.

The Tier 4 program is staged to phase-in over a number of years reflecting both the time and effort that we believe engine manufacturers will need to appropriately transfer the advanced emission control technologies to nonroad diesel engines. Similarly, this extended implementation schedule considers the time between the Tier 3 standards and the Tier 4 program needed for equipment manufacturers to redesign nonroad equipment to accommodate the new technologies. We are projecting that this lead time is sufficient to allow for redesign, manufacture and approval of new nonroad equipment for Tier 4 engines. Finally, the implementation schedule for the NR Tier 4 program considers the timing and technologies of the heavy-duty 2007 on-highway emission program. The similar, advanced emission control based, NR Tier 4 standards do not begin to phase-in until 4 years after the heavy-duty 2007 rule begins.

The diversity of nonroad engine duty-cycles as noted by the commenter was an important consideration of the Agency in evaluating appropriate technology options for the Tier 4 program. Chapter 4.1 of the RIA specifically evaluates this question for a significant number of known nonroad operating cycles. Further, we recognize that it would be impossible in a finite analysis to consider every possible way that a nonroad diesel engine could be used. This is also a practical limitation of the engine manufacturers. For this reason we are expecting (and have estimated a cost for, see RIA chapter 6) that

Tier 4 engines with diesel particulate filter systems will have automatic active backup PM filter regeneration systems. This means that should a nonroad piece of equipment be used in an application whose duty-cycle is not well matched for passive PM filter regeneration (the predominant mechanism for filter regeneration, see preamble II.B and RIA 4.1), an active means will be automatically engaged to ensure reliable filter regeneration and emission control. Such technologies are already well proven for light-duty diesel applications (more than 500,000 passenger cars in Europe) and have also been applied in more limited ways to nonroad equipment already today (see RIA Chapter 4.1.3.1.1). Similarly, light and heavy-duty engine manufacturers have developed active regeneration strategies for NOx adsorbers (such as changes to EGR and fuel-injection strategies) which are applicable to nonroad diesel engines. Id. and RIA Chapter 4.1.2.3.2 and Highway Diesel Progress Review Report 2.

The commenter similarly raises concerns regarding ram-air effect and other impacts on engine and charge-air cooling which are different for nonroad diesel engines when compared to similar on-highway diesel engines. We agree with the commenter that such unique nonroad issues must be considered, and we have appropriately given consideration to these issues (see Preamble Section II.A, II.B and RIA Chapter 4.1). We gave specific consideration to these issues when we set the Tier 2 and Tier 3 emission standards and have similarly considered these issues in the Tier 4 program. The NOx standards for nonroad diesel engines in Tier 4 are in all cases somewhat higher than the comparable on-highway emission standards due to the lack of ram-air. Also, where we are setting EGR based emission standards (for engine 25-50 hp and >750 hp) we have made a specific analysis of the additional cost for engine cooling (see Chapter 6 of the RIA). Since PM filters operate with essentially equal efficiency in different operating modes (see e.g. RIA 4.1.1.3.1), and having the backup (i.e. active) regeneration system assures that the filter will operate (i.e. not plug), we think issues of feasibility of the PM standard is settled. (We have included costs of the active regeneration system in our cost estimates, as noted above and in other responses.)

Regarding technical feasibility of the NOx standard, the commenters also highlight unique concerns for the very largest diesel engines (those with rated power >750 hp in our analysis) and the need for larger heavier emission control systems. Based on comments such as these and our own analysis of the potential concerns for the largest heavy-duty diesel engines, we have made several changes to the Tier 4 program for engines in the power category >750 hp. Specifically, we are finalizing a PM standard that is slightly higher (0.02 for genset engines and 0.03 for mobile machines) giving consideration to concerns regarding use of very large ceramic substrates in parallel systems and the potential for improved durability that could be realized by using slightly less efficient depth filtration technologies (wire or fiber mesh filter technologies).

We disagree with commenters suggesting that lawn and garden equipment are somehow unique in the realm of nonroad diesel equipment and the assertion that proven solutions used in other nonroad applications can not be applied to lawn and garden equipment. Quite to the contrary, lawn and garden equipment would be expected to experience lower levels of impact vibration when compared to mining or excavating equipment. Regarding unique product safety concerns and OSHA requirements, as we describe in the RIA (and in the draft RIA), the challenge regarding safety and the potential for igniting combustible materials will be less for Tier 4 nonroad diesel equipment than it already is for today's existing gasoline based systems (e.g., surface temperatures for the muffler of a small gasoline engine). Further, we list a number of technologies available to mitigate such concerns where they may exist. We do not believe the Tier 4 emission technologies significantly change these characteristics.

The issues with space constraints typified by small equipment with transversely mounted engines (such as the skid steer loader and mini-excavators cited the comments) and challenges with respect to maintaining sufficient catalyst temperatures for proper operation of the exhaust emission control systems at very light loads are also faced by the manufacturers of light-duty automobiles. Light-duty vehicles must be capable of operation both at highway speeds and in congested urban traffic with large amounts of idle time, while still meeting the demanding constraints of performance, safety, emissions, and durability design targets and emissions and safety standards. With respect to packaging, three-way catalysts, and in particular close-coupled three-way catalysts have been successfully designed and packaged into extremely challenging platforms (e.g., small transverse front-drive light-duty vehicles) in order to meet the stringent U.S. light-duty Tier 2 standards while still meeting engine compartment thermal-management and other design constraints. Similar compact system designs are now been applied to a combination NOx adsorption catalyst/PM trap system on a small, low emission, transverse-front-wheel-drive light-duty diesel vehicle that recently went on sale in Europe: the 2004 Toyota Avensis D-CAT diesel. In this vehicle, a NOx adsorption catalyst flow-through substrate and a combination CDPF and NOx adsorption catalyst wall-flow substrate are both packaged into a close-coupled catalyst that is integrated directly into an extremely tight space by integrating the double-walled catalyst housing directly into the turbocharger downpipe. This vehicle uses its electronic engine management system, high-pressure common-rail injection, and other systems to provide the thermal management and management of exhaust chemistry needed to force PM regeneration, NOx regeneration, and SOx regeneration at very lightly-loaded conditions including extended idle conditions (see memo to Air Docket A-2001-28, OAR-2003-0012-0867). We believe such examples clearly show that it is possible to address tight packaging constraints through careful design. Further, they highlight the substantial developments for on-highway products to address similar design issues as will need to be addressed for nonroad Tier 4 diesel engines and equipment.

In summary, the commenters raise a number of important issues regarding the uniqueness of nonroad diesel equipment especially in comparison to the on-highway products EPA has identified as the starting point for technology migration for Tier 4. We gave careful consideration to these issues in our proposal and further we have made additional modifications in this final rulemaking to address these issues. We are confident that the Tier 4 program can be implemented successfully in the timeframe provided under the program.

3.2.1.3 Analysis is Incomplete

What Commenters Said:

AGCA, AEM, EMA, and AFB (including various state Farm Bureaus) all believe that the analysis provided in the proposal is not adequate to show that the proposed standards are technologically feasible.

AGCA and AEM commented that we should perform a thorough evaluation of the technological feasibility and the related cost effectiveness of the proposed rule. They stated that the burden of regulatory compliance is not the sole domain of the engine maker, but is shared throughout the entire chain of the nonroad equipment industry including the equipment user. They believe that there are several critical elements of the rule that need to be addressed in order to ensure that the technology exists and is feasible for all impacted nonroad equipment, and that we should evaluate the application of aftertreatment technology for nonroad machines by power category. The commenters do not believe that the transferability of on-highway like technologies to small engines and very large engines will be practical or cost effective given their small contribution to the emissions inventory.

Further, EMA commented that we failed to propose standards that are technologically feasible. They added that EPA is obligated under CAA Section 202(a)(3)(A) (sic) to propose standards that are technologically feasible and cost-effective. EMA believes that we failed to meet our obligations with respect to various aspects of the proposed heavy-duty engine program and have failed to fully analyze the additional stringencies and infeasibility concerns related to the supplemental test procedures and emission limits, including the NTE requirements – and as a result, we have not provided an adequate overall analysis of the technological feasibility and cost-effectiveness of the proposal.

The National Association of Wheat Growers and AFB (including the IL, KS, MI, NE, and TN Farm Bureaus) commented that the proposal does not include adequate analysis regarding the transferability of onroad technology to all varieties of nonroad equipment and engine retrofit requirements and costs, including the impact on the used equipment market. There was also a concern that this rulemaking would requirement equipment owners to replace their old equipment with newer ones, or would otherwise require existing engines to be retrofitted or rebuilt to meet the new standards.

Letters:
American Farm Bureau, OAR-2003-0012-0608 p. 2-3
Associated General Contractors of America, OAR-2003-0012-0791 p. 10
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 108
Illinois Farm Bureau, OAR-2003-0012-0673 p. 1
Kansas Farm Bureau, OAR-2003-0012-0825 p. 2
Michigan Farm Bureau, OAR-2003-0012-0625 p. 1-2
National Association of Wheat Growers, et. al., OAR-2003-0012-0752 p. 2
Nebraska Farm Bureau, OAR-2003-0012-0514 p. 1-2
Tennessee Farm Bureau, OAR-2003-0012-0629 p. 1
Chicago Public Hearing, A-2001-28, IV-D-06 [AEM p. 221]

Our Response:

We disagree with commenters who assert that the Tier 4 analysis is inadequate for the Administrator to determine the feasibility and appropriateness of the Tier 4 standards. Quite to the contrary, we determined that the Tier 4 Preamble, RIA, and supporting technical documentation including the 2007 RIA, EPA's Highway Diesel Progress Review Reports, EPA Contractor Studies and a wide range of technical papers included in the Tier 4 docket provide overwhelming evidence that the Tier 4 standards are feasible and appropriate. Further, these standards are based on technologies which are already in use today on diesel engines used in a wide range of applications, including nonroad applications. To suggest that the technologies cannot be developed further for broader application to a wide range of nonroad equipment is inaccurate. Indeed, these commenters (with minor exceptions) provided no data to support their contentions, but rather relied on general, undocumented assertions.

We agree that there are some unique nonroad engine and equipment issues which must be considered in setting these standards, and we have appropriately addressed those issues in developing the Tier 4 program. See response to comment 3.2.1.2.

EPA has conducted a thorough feasibility and cost analysis for this program with consideration to different horsepower categories as detailed in the Preamble and RIA. Our estimates regarding the cost effectiveness of the program are based on these analyses and can be found in Chapter 8 of the RIA.

The commenters' basis for contending that standards for "small" and "very large" nonroad diesel engines are not practical or not cost effective is unclear. Chapter 12 of the draft RIA for the Tier 4 NPRM included several analyses specific to engines below 75 horsepower and above 750 hp (the categories the commenter appears to be referring to). Those analyses showed that failure to set new Tier 4 emission standards for engines >750 hp could mean foregoing potential NOx reductions of 742,000 tons and potential PM reductions of 30,000 tons (30 year net present value). Further, the analysis estimates the benefit of those potential emission reductions at $18 billion with an incremental cost of $0.5 billion (i.e., a benefit to cost ratio of more than 30:1). Similarly for the engines <75 hp, the proposed Tier 4 program was estimated to result in NOx +NMHC emission reductions in excess of 300,000 tons and PM emission reductions in excess of 120,000 tons (30 year net present value). The estimated benefit for these reductions was $70 billion at a cost of less than $4 billion. At proposal, we gave specific consideration to the appropriateness of emission standards for both small and large nonroad diesel engines, and we concluded that the proposed Tier 4 standards for those categories of engines were appropriate. Although, we have made some changes to the >750 hp emission standards giving consideration to the unique challenges present in that horsepower category, the underlying importance of realizing significant emission reductions for this category of engines remains unchanged. The commenter provides no new evidence that causes us to reconsider this conclusion.

With regard 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 213 (the commenter erroneously cited to section 202) 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 later time. See, e.g., National Petrochemical & Refiners Ass'n v. EPA, 287 F. 3d 1130, 1136 (D.C. Cir. 2002) (upholding in all respects the 2007 HD standards, the standards the commenter states lacked adequate record support). Our NPRM, draft RIA and supporting technical documents contain 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 results from EPA's most recent Highway Diesel Progress Review. 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.

Finally, with regard to the concern that this rulemaking might requirement equipment owners to replace their old equipment with newer ones or might require existing engines to be retrofitted or rebuilt to meet the new standards, we note that the standards we are setting apply only to new engines. Today's rulemaking does not require owners of existing engines to change or replace those engines.

3.2.1.4 Feasibility of Aftertreatment Devices

What Commenters Said:

API commented that we should address issues related to the use of aftertreatment devices on nonroad engines. Given the multiple rebuilds, high usage rates, and long life spans of nonroad diesel engines, they believe that it is unlikely that aftertreatment systems will function effectively for the full life of the equipment. In the event of equipment failure, operators must know that they have options for replacement parts. They added that in the light-duty vehicle/truck arena, we have established an aftermarket catalyst certification program to ensure that vehicle owners have access to reasonable choices for replacement parts while ensuring some level of continued emissions performance. Because nonroad diesel engines are generally operated significantly beyond the original warranty period, they believe that operators will not receive the same consumer protection absent an EPA program or policy to facilitate aftermarket catalyst devices. API believes that we have not addressed this issue and 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. Further, ARA commented that adding emissions control may result in increased equipment downtime. They stated that the thermal management problems associated with NO_x control could be problematic with the addition of particulate filters in some nonroad applications, especially when coupled with future OBD requirements.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 23
American Rental Association, OAR-2003-0012-0612 p. 3

Our Response:

We believe that our rebuild regulations contained in 40 CFR §89.130 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. Regarding replacement parts that may be installed on engines after their full useful life, EPA has existing aftermarket part certification regulations for light duty vehicles, as the commenter notes, that allow part suppliers and purchasers to determine whether the part will continue to allow satisfactory emission performance. EPA may consider creating similar regulations in the future to address unique concerns that may arise on nonroad diesel engines but we can not finalize such provisions here as they were not proposed.

3.2.2 PM Control

3.2.2.1 Feasibility

What Commenters Said:

The Standards are Feasible

MECA and NESCAUM commented that they believe that the PM standards are feasible within the proposed time frame, provided ultra low sulfur (15 ppm) fuel is available. Filter technologies that achieve PM reductions of 90 percent or more are feasible and cost-effective for engines above 25 hp.

MECA provided additional discussion on the commercial availability, durability, and effectiveness of DPFs. They specifically noted that where diesel fuel with < 15 ppm sulfur is used, precious metal catalyst-based diesel particulate filters (CB-DPFs) have consistently demonstrated the capability to reduce PM (on a mass basis), carbon-based PM, and hydrocarbon species and PAHs by over 90 percent, 99.9 percent, and 80 percent, respectively. In addition, systems are emerging that are designed to provide exhaust flow turbulence and increased particulate residence time, achieving PM reductions in the 40 to 65+ percent range. MECA cited one design currently being evaluated for passenger car and heavy truck application in Europe (as described in New Diesel Catalyst Systems to Achieve European Legislation Tested on a Volvo S60 Passenger Car, 24th Vienna Motor Symposium, May 15-16, 2003, Vienna, Austria) and noted that another design is being developed for nonroad engines, including those under 50 hp. CARB also noted recent testing by the Southwest Research Institute (SRI) under joint contract with ARB and EPA clearly demonstrated that the proposed PM standards for several nonroad diesel engines using particulate filters and 15 ppm sulfur fuel is achievable. They added that the results for two of the prototype engines are available in an interim final report from SRI titled "Application of Diesel Particulate Filters to Three Nonroad Engines," February 2003.

Further, MECA stated, diesel oxidation catalyst (DOC) technology is available today and represents a cost-effective, interim PM control strategy for nonroad engines less than 75 hp. They believe the technology could be applied to nearly the entire range of nonroad engine applications in 2008 when the 500 ppm sulfur diesel is available.

<u>*The Standards May Not Be Feasible*</u>

EMA and AGCA commented that the PM standards may not be feasible given the challenges associated with the transfer of emission reduction technologies to the nonroad engine. EMA stated that we note that oxidation catalysts can be applied to nonroad diesel engines in order to meet the interim Tier 4 PM reduction standards for 2008; however, they believe that the effectiveness of oxidation catalysts is highly temperature and load dependent. They further stated that this technology generally does not reduce emissions at low loads and temperatures and efforts to improve the effectiveness at light loads by making the oxidation catalyst more "active" can result in an increase in sulfate formation at high loads. EMA believes that we have failed to account for the fact that oxidation catalysts can actually increase PM sulfate emissions under certain high load (i.e. high exhaust temperature conditions). Engine manufacturers have provided data to EPA illustrating this effect. Where this occurs, overall PM levels are not reduced and, in fact, can be increased at medium to high loads (over the 8-mode test cycle) when there is too much sulfur (> 300 ppm) in the fuel. Therefore, an oxidation catalyst will reduce PM emissions only when operated at high load and when used with low sulfur fuel (< 300 ppm) and given the potential increase in sulfate PM, will not provide real reductions of PM in the field.

AGCA believes that we are relying too heavily on PM emissions reduction technologies that are still under development for highway applications and may not be readily transferable to nonroad applications. They stated that even though MECA has noted that technology to reduce diesel PM emissions is available and that DOCs and DPF have been used for both onroad and nonroad applications, these statements are not complete. The vast majority of PM emissions solutions have been employed on engines within the 75 to 600 hp range only, which are commonly found in highway applications. However, the nonroad standards would require PM reductions from a much larger range of engines from 8 to over 3,000 hp. Therefore, AGCA stated, PM aftertreatment for certain nonroad engines could require costly electronic components that are not currently included in the engine or equipment design in the smaller powerbands. They believe that this could adversely affect engine performance, fuel economy, and engine durability and could substantially increase the price of the equipment.

EMA further added that they do not believe it will be feasible to apply PM filter technology to larger nonroad engines (above 750 hp). For nonroad engines greater than 750 hp, there are significant challenges associated with the use of multiple parallel PM filters. A large number of parallel filters must be used on the larger engines if on-highway technology is to be used directly. A 600 hp highway truck will require at least two parallel filters, while a 3,000 hp engine will require up to five times as many, or 10 parallel PM filters. Each filter must reach sufficient temperatures to burn out the accumulated soot, but the filters will not all run at the same temperatures and only some will reach sufficient temperatures to burn out the soot. Excessive soot accumulation in the cool-running filter can lead to excessive thermal gradients causing cracks or temperatures so high that the ceramic trap will melt, or causing a pressure drop across the filter. The likelihood of at least partial failures and cracks allowing soot bypassing for large filters made up of smaller segments or of multiple parallel units is high. Therefore, without substantial new technology development, it will not be feasible to apply PM filter technology in these applications.

Euromot and SBA Office of Advocacy commented that applying PM filter technology to smaller nonroad engines will be technologically difficult. They added that the need for automatic regeneration of PM filters has been noted as one of the most important feasibility issues for small diesel engines by Euromot (see EMA/Euromot, Investigations into the Feasibility of PM Filters for Nonroad Mobile Machinery, at 11-18, Aug. 31, 2002). A recent study by the Southwest Research Institute also acknowledges this issue (see Southwest Research Institute, Nonroad Emissions Study of Catalyzed Particulate Filter Equipped Small Diesel Engines, Sept. 2001). The information in these reports indicate that the backpressure in small engines would require the owners to periodically, or perhaps frequently, manually regenerate and clean out the CDPFs. The commenters believe that this is inconsistent with EPA's position that it would be possible to automatically regenerate the CDPFs for small engines. The market viability of products requiring manual regeneration would be significantly imperiled by the lack of an automatic feature since owners are unlikely to buy equipment with such aggressive maintenance requirements. Though EPA believes that automatic regeneration systems might be developed by 2013 for engines below 75 hp, these commenters believe that the availability of this technology in that timeframe remains uncertain.

SBA Office of Advocacy also believes that we did not present data showing that small engines will be able to operate at the temperatures needed to facilitate proper particulate destruction and catalyst regeneration. They stated that we acknowledged that this was an issue and should present additional data in this regard. They added that information has been submitted during the development of the proposed rule by small entity representatives such as AEM, which submitted an EMA study that includes test results that demonstrate insufficient exhaust temperatures for passive regeneration. SBA Office of Advocacy also commented that we did not fully address the issue of where manufacturers of compact machines are expected to place aftertreatment devices such as PM filters. Lawn and garden equipment applications have specific packaging concerns as illustrated by comments submitted by small entities to EPA during the SBAR Panel process. They believe that we have not provided sufficient evidence for the assumption that aftertreatment devices can be made to fit under the equipment hoods of lawn and garden equipment or that equipment packaging concerns can be overcome. SBA Office of Advocacy also commented that the feasibility and cost for this type of redesign for small business equipment manufacturers remains uncertain. They provided additional discussion on this issue and the document issued by the Southwest Research Institute entitled "Nonroad Emissions Study of Catalyzed Particulate Filter Equipped Small Diesel Engines," September 2001, as supporting documentation.

The National Mining Association (NMA) commented that EPA should consider the experience of the Mine Safety and Health Administration (MSHA) in setting new emission standards for nonroad diesel engines. They note the value of conducting research prior to promulgating new regulations to help identify potential issues related to cost, impacts on day to day operations, the safety and health of workers, and the ability to perform maintenance. In particular, they note the possibility that catalyst technologies may generate unexpected secondary emissions and provide as an example experience showing catalyzed diesel particulate filters can increase nitrogen dioxide (NO2) emissions by 10 fold.

Lastly, Lister Petter agrees with EPA that given the difficulties associated with cost and availability, PM traps should not be required for engines under 19 kW.

Letters:
Associated General Contractors of America, OAR-2003-0012-0791 p. 8
California Air Resources Board, OAR-2003-0012-0644 p. 3
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 14, 19-20
Euromot, OAR-2003-0012-0822, 0823 p. 6
Lister Petter, OAR-2003-0012-0155 p. 3
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 2-3
National Mining Association, OAR-2003-0012-0510 p. 2-3
U.S. Small Business Administration Office of Advocacy, OAR-2003-0012-0815 - 0818 p. 6-8
New York Public Hearing, A-2001-28, IV-D-05 [MECA p. 118; NESCAUM p. 97]
Chicago Public Hearing, A-2001-28, IV-D-06 [MECA p. 46]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [CARB p. 70, 139]

Our Response:

We agree with commenters noting that catalyzed diesel particulate filters (CDPF) enabled by 15 ppm sulfur diesel fuel are a well proven technology that can be applied across a wide range of nonroad diesel engines. As noted previously in our response to 3.2.1.1, we have made certain modifications from our proposal respecting unique issues for the largest nonroad diesel engines with rated power above 750 hp. We appreciate the additional technical data provided further substantiating the proven viability of CDPF technology and its ability to realize PM reductions in excess of 90 percent.

We appreciate the additional information provided by the commenter regarding impact of sulfur on diesel oxidation catalysts (DOC) and the commenter's concern that the impact (increased sulfate PM emissions) may be incompatible with the interim 2008 Tier 4 PM standards for engines <75 hp. We have specifically considered the issue of PM formation (sulfate make) from diesel oxidation catalysts when operated on 500 ppm sulfur diesel fuel. This is one reason that we did not set a more stringent standard for engines in this power category as a number of commenters argued would be appropriate. As we explain in Section II.B of the Preamble and Chapter 4.1.4.3 and 4.1.5.3 of the RIA, DOCs can reduce PM emissions even with 500 ppm sulfur diesel fuel given the appropriate design of the catalyst coating. Further, we are finalizing a provision that will allow engine manufacturers in 2008 to certify engines under 75 hp to the interim Tier 4 PM standards on 15 ppm sulfur diesel fuel if they take appropriate actions to ensure that 15 ppm sulfur diesel fuel (which will be widely available after 2006) is used with the engine. See Preamble Section III.D for a description of this provision.

We agree with commenters that point out the diversity of nonroad equipment and the need to consider whether on-highway emission solutions can be further developed and applied to nonroad diesel engines. However, we disagree with the suggestion that simply because there are some differences between on-highway and nonroad diesel engines that we should simply conclude that the technologies cannot be applied to nonroad equipment. Instead, careful analyses as described in Preamble Section II and RIA Chapter 4.1 (and in Chapter 4.1 of the Draft RIA) are needed to define the similarities and differences between on-highway and nonroad diesel engines. Further, having defined the relevant differences consideration must be given to the possibility for engineering solutions to address nonroad specific issues. We have done that in our Tier 4 program and have adjusted the emission standards and the timing of those standards in a number of ways to reflect important differences between on-highway and nonroad diesel engines.

First, we should be clear about the fundamental similarities between on-highway and nonroad diesel engines regarding PM emission control with a PM filter (see Chapter 4.1 of the RIA for additional detail). All diesel engines produce PM emissions composed primarily of organic materials (semi-volatile hydrocarbons and solid carbon particles, soot). These PM compounds can be captured in a PM filter with high efficiency (approaching 100 percent for ceramic based wall flow filters). The capture efficiency of PM filters is only a function of the filter media design and PM soot loading level. Filtering efficiency is independent of engine size or operating mode. Thus, a PM filter is highly effective at capturing and reducing PM emissions for any diesel engine (on-highway or nonroad), during both transient and steady-state operation. The captured PM must be oxidized in order to prevent filling the filter completely with PM. This process is called regeneration and is primarily dependent on exhaust temperatures. Absent adequate high exhaust temperatures PM filters can fail due to excessive PM accumulation in the filter. For both on-highway and nonroad diesel engines it is conceivable that absent control of exhaust temperatures excessive PM accumulation could occur. For this reason on-highway engine manufacturers have developed active backup regeneration technologies that can automatically raise exhaust temperatures in order to promote PM oxidation in order to regenerate the PM filter. Such systems are well proven in automotive applications today and, as our recent Highway Diesel Progress Review Report 2 discusses, are being developed for heavy-duty on-highway applications in 2007. The exhaust temperature necessary to regenerate a PM filter is defined by chemical property and is not a function of engine size nor of whether the engine is used in a nonroad or on-highway application. The mechanisms employed to raise exhaust temperatures in active backup regeneration systems are also not fundamentally limited by engine size or application although they may require the addition of technologies not currently applied to some engine categories.

Yet, in spite of these fundamental similarities there are differences to which we have given specific consideration in setting the Tier 4 standards. We have set a slightly relaxed PM standard of 0.02 g/bhp-hr for engines between 25 and 75 hp recognizing that sulfate emission levels will be slightly higher from these engines due to their higher brake specific fuel consumption levels. We have not set a diesel particulate filter-based PM standard for engines below 25 horsepower because we cannot today say with confidence that the active backup regeneration systems needed can be appropriately applied to these engines. The commenter here has made the same suggestion for engines between 25 and 75 horsepower; however we disagree with this assertion as detailed in RIA Chapter 4.1.4.3.2.1, and Preamble Section II.B. Regarding the suggestion by the commenter that the cost for engines in this category would be unduly expensive see RIA Chapter 6 for our cost estimates, RIA Chapter 10 for our economic impact analysis and the discussion in Chapter 12.4.3 and 12.6 of the Draft RIA giving particular consideration to the cost effectiveness of the PM standards for these engines. In short, we have estimated the cost for applying the needed technologies for these engines, we have evaluated the economic impact of these costs and we have concluded that the it is appropriate to set the PM standard at the 0.02 g/bhp-hr level given consideration to cost, safety and the potential emission reductions. The implementation schedule for engines in this horsepower category (beginning in 2013) also reflects our recognition that substantial leadtime (9 years in this case) is appropriate to allow for the redesign of nonroad diesel engines and equipment to apply this technology.

In addition to the differences noted for smaller nonroad diesel engines, we have also given consideration to the differences for the largest engine category, those above 750 hp. There we have set a PM standard of 0.02 g/bhp-hr for gensets and 0.03 g/bhp-hr for nonroad mobile machines reflecting the use of a slightly less effective PM filter media (wire or fiber mesh depth filters). We have done this because we recognize that data relative to the development of very large ceramic based PM filters is limited and that there are specific concerns with the application of multiple smaller filters. Thus we cannot conclude today with sufficient certainty that such solutions will be appropriate in the timeframe needed. However, we should be clear that we do believe such developments may occur and we are not precluding in any way the future application of the more effective PM filter media to engines in this power category. In addition to the purely technical differences noted here, we have also given consideration to the relatively low volumes of these largest nonroad diesel engines in determining the appropriate timeframe to require compliance with these new standards. The substantial leadtime provided here (nearly 11 years until 2015) provides ample time for engine and equipment manufacturers to plan and implement redesigns of engines and equipment to accommodate new technologies.

Regarding comments concerned with frequent manual cleaning-out of PM filters, we believe it likely that engines below 175 horsepower can be designed such that PM filter maintenance to remove ash will be unnecessary. EPA's recent Highway Diesel Progress Review Report 2 documents two new diesel PM filter designs which in light-duty diesel passenger car applications are designed to be maintenance free for the life of the vehicle. This is accomplished by designing the filter geometry and materials to significantly increase the ash storage volume of the filter. Such filters can store an engine's lifetime ash emissions while maintaining PM control to the emission standards and without excessive build up of exhaust backpressure. Such solutions are equally applicable to nonroad diesel engines.

In our cost analysis, we have assumed that ash cleaning maintenance occurs at the minimum maintenance interval spelled out in EPA regulations (e.g., 3,000 hours for engines <175 hp). More frequent maintenance is generally not allowed. By using this interval, while believing it likely that actual maintenance intervals will be longer (in fact in some cases unnecessary over the life of the vehicle), we have made a conservative estimate of the potential costs for diesel PM filter ash maintenance.

Finally, it should be noted that the commenter, SBA Office of Advocacy, included in their comments a discussion of the Euromot-EMA report “Investigation into the Feasibility of PM Filters for Nonroad Mobile Machinery”, a copy of which is available in EPA Air Docket A-2001-28. In this report, EMA/Euromot discuss two types of active PM filter regeneration methods. One method is similar to the active back-up regeneration techniques we believe nonroad engine companies will use to comply with the Tier 4 program and discussed in detail in Chapter 4 of the RIA. That method is based on a variety of means of providing supplemental heat to the PM filter to increase the exhaust gas temperature to the level at which PM will oxidize. The second method discussed in the Euromot-EMA report for active filter regeneration is the actual removal of the PM filter from the equipment and the subsequent heating of the filter in a specialized oven. Such techniques have been used in mining operations in Europe and the U.S., where each night the filters are removed, placed in an oven to force regeneration, and than reinstalled in the equipment the following morning. We want to be clear that this type of filter regeneration is not the basis for EPA's Tier 4 standards, and, in fact, such a system would likely not be allowed in the U.S. as a means to comply with Tier 4 standards, as it requires PM filter maintenance on a very frequent schedule and would not meet the EPA regulations for minimum PM filter maintenance intervals. To the extent the commenter believes this second type of PM filter maintenance is inconvenient, we would agree, but such systems are not the basis of EPA's feasibility or cost assessments for the Tier 4 standards.

Regarding the concerns that AGCA raises regarding the cost of electronic controls and the impact of new control technologies on engine performance, fuel economy, and durability the comment includes no information or analysis to substantiate these concerns. Moreover, the additional cost for electronic controls (and other technologies as appropriate) are estimated in detail in chapter 6 of the RIA. Similarly, the impacts on fuel economy (both positive and negative) are expressly analyzed in chapter 6 and are included in overall cost analysis. Regarding impacts on durability and performance it is clear from the on-highway experience that new more sophisticated electronic control systems on diesel engines improve the flexibility, reliability and overall performance of diesel engines by virtue of the control system's ability to adapt to any number of different operating conditions. Finally, chapter 10 of the RIA documents an in-depth economic model of the impact of the new emission control technologies on equipment price and sales volumes.

We appreciate the comments from the National Mining Association regarding the experience of the Mine Safety and Health Administration, and further, we agree that research as well as studies of relevant experience in other fields can be a valuable part of the regulatory development process and the regulatory implementation process. Our nonroad Tier 4 program is based significantly on the experience of existing retrofit programs with catalyzed diesel particulate filters (CDPFs) both for on-highway applications and in the various construction programs include the Swiss VERT program. The evidence from those programs does not cause us to believe that increased NO2 emissions (as a fraction of total NOx emissions) pose a significant risk to public health or welfare. To be clear, the total NOx emissions are not changed by CDPFs; it is only the relative fraction of NO2 and NO in the total NOx emissions that is changed.

However, we agree with the commenter that it is prudent and appropriate that research continue to confirm that potentially harmful secondary pollutants are not formed from new technologies, catalytic or otherwise. For this reason, the Agency is funding new research at the Health Effects Institute to test new diesel emission engine technologies (i.e., the technologies we expect will be used for compliance with the HD 2007 program, and our nonroad Tier 4 program) specifically for increased emissions of unregulated pollutants. Further, the Agency continues to work with the California Air Resources Board (CARB) to evaluate the potential impact of NO2 emissions. The results from these programs, as well as extensive field experience from heavy-duty diesel engines for on-highway trucks in the 2007 program, will provide the Agency with additional information prior to nonroad Tier 4 implementation.

See response to comment 3.2.1.2 for our response to concerns regarding the redesign and packaging on emission control technologies on small nonroad equipment.

3.2.2.2 Efficiency of DPF Filters

What Commenters Said:

Deutz commented that we overestimated the efficiency of DPF filters. They added that there is considerable, reliable data available indicating that lower filter efficiencies should be expected. First, at the August 6-7, 2003 "2007 Clean Diesel Implementation Workshop," Ricardo presented test results showing 83 percent DPF efficiency. Second, the U.S. Department of Labor Mine Safety and Health Administration has certified numerous particulate filters, all with efficiencies in the 85 to 87 percent range. Third, Deutz has previously presented test data to EPA showing DPF efficiencies ranging from 79 to 88 percent on a wide range of fuel sulfur.

Letters:
Deutz, OAR-2003-0012-0820 p. 1

Our Response:

We recognize, as the commenter notes, that not all PM filters exhibit the same level of emission reduction (percentage reduction) and that other factors including the sulfur content of diesel fuel can impact the PM reduction noted. We have given specific consideration to these facts in setting the PM emission standards (see in particular the discussion of standards for engines from 25 - 75 hp in Preamble Section II.B). However, in general we contend that diesel particulate filters can enable compliance with the 0.01 g/bhp-hr standard when operated on 15 ppm sulfur diesel fuel for a wide range of nonroad diesel engines (75 hp - 750 hp). We have presented substantial data in Chapter 4.1 of the RIA showing emission reductions consistently in excess of 90 percent. Further the data shows the ability to comply with the standard over the various emission test cycles and the NTE.

The data the commenter cites is somewhat misleading because it is presented in terms of percent reduction instead of total reduction. PM filters do not control sulfate PM and as Chapter 4.1 of the RIA details, sulfate PM can make up a substantial fraction of the total PM from a PM filter equipped diesel engine. The RIA shows data where the residual sulfate PM level could approach 0.009 g/bhp-hr. This level of residual sulfate PM is dependent on the fuel sulfur level and not the efficiency of the PM filter, nor the base PM level from the engine. Thus if the base PM emission levels are below 0.09 g/bhp-hr the resulting emission reduction could be less than 90 percent, yet the total emissions would be below the 0.1 g/bhp-hr emission standard. This is the case for the emission data cited from the Ricardo presentation referenced in the comment.

We have submitted a copy of the Ricardo/AECC report that was the basis of the comment to the nonroad docket (OAR-2003-0012-0915). The report shows that after 1,000 hrs of aging, the PM emissions were reduced across a PM filter from 0.05 g/bhp-hr engine-out to 0.008 g/bhp-hr after the filter over the European Transient Cycle (an 83 percent reduction). The results over the European Transient Cycle were similar with engine-out emissions of 0.05 g/bhp-hr and emissions after the PM filter of 0.005 g/bhp-hr (89 percent reduction). While the data does support the commenters contention that PM filters are not always more than 90 percent efficient, it does not support EPA setting a more relaxed PM emission standard. Rather, it simply highlights a vagary of mathematics. As the base level of the engine-out emissions decrease, the percent reduction realized to the same endpoint (the endpoint being nearly fixed by the sulfate emission level) is decreased. EPA regulations do not require that engine manufacturers demonstrate a 90 percent emission reduction, only that they demonstrate emissions below the level of the standard.

For additional discussion of the impact of sulfur on PM emissions and how this impacts the efficiency of PM filters see RIA Chapter 4.1 and the Chapter 3 of the Heavy Duty 2007 RIA.

3.2.3 NO_x Control

3.2.3.1 Feasibility

What Commenters Said:

<u>*The Standards are Feasible*</u>

MECA, NESCAUM, and CARB all commented that the NO_x standards are feasible provided low sulfur (15 ppm) fuel is available. They added that standard is technically and economically feasible in the timeframe proposed using a number of NO_x reducing technologies such as NO_x adsorbers. They believe that this technology will be available for nonroad engines ranging from 75 hp to greater than 750 hp. Over the past two years, significant advances have been made in the development of durable and highly effective NO_x adsorbers, with studies showing greater than 90 percent reduction in heavy duty diesel NO_x emissions. MECA provided additional discussion on this issue, noting that the current focus of NO_x adsorber technology development and optimization is on expanding the operating temperature window in which the technology will perform, improving the thermal durability of the technology, improving the desulfurization methods and performance, and improving system packaging and integration. They added that even though NO_x adsorber catalysts are not currently available for nonroad diesel engines, they will be available for use within the leadtime provided in the proposal and that the incorporation of on-highway type fueling systems will allow for the use of this technology on smaller diesel engines as well.

MECA believes that Selective Catalytic Reduction (SCR) technology is a strategy that could be used to help meet the proposed nonroad diesel emission standards for NO_x. They commented that SCR has recently been applied to select mobile sources and in 2005, it is expected to be used for on-road diesel HDE engines to help meet the Euro 4 emission standards. SCR is capable of reducing NO_x, PM and HC emissions from diesel engines and has already been installed in a variety of marine applications ranging from 450 to over 10,000 kW.

MECA noted that low-pressure EGR is being successfully demonstrated in retrofit applications on trucks, buses, and other applications, is capable of reducing NO_x by 30 to 60 percent, and is a viable option for controlling NO_x emissions from nonroad engines. They added that with an active DPF and sulfur levels below 15 ppm, control levels as high as 80 percent may be achieved; and current experience with this control technology has been in the 185 to 440 hp range but can be optimized for a larger range of engine categories.

Lastly, MECA commented that lean NO_x catalyst (LNC) technology was recently verified by CARB (25 percent NO_x control) in retrofit applications and is being demonstrated and commercialized for a variety of nonroad applications, including heavy-duty earthmoving equipment, agricultural pumps, and portable engines.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 3
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 2-4
New York Public Hearing, A-2001-28, IV-D-05 [MECA p. 118; NESCAUM p. 97; CARB p. 139]
Chicago Public Hearing, A-2001-28, IV-D-06 [MECA p. 46]

The NO_x Standards May Not Be Feasible

EMA, SBA Office of Advocacy, AGCA, and Ingersoll-Rand all commented that the NO_x standards may not be feasible for certain nonroad engines. EMA added that it is inherently more difficult to cool nonroad equipment and machines than trucks, the task of lowering NO_x becomes inherently more difficult than it is for on-highway applications. Nonroad machines typically operate at very low ground speeds or are stationary and as a result, there is no "ram air" effect to aid cooling systems. They commented that nonroad equipment relies almost entirely on the ability of cooling fans to move enough air to cool all the systems, which requires additional power from the engine.

AGCA commented that we are proceeding with aggressive NO_x emissions reductions in the absence of existing NO_x emissions reduction technology. Even though MECA has stated that NO_x technology will be readily available in the future, this premise is based on the fact that SCR technology has been used on stationary sources and some mobiles. They also added that MECA's argument that NO_x adsorbers can be transferred to nonroad applications is not convincing since many technological challenges remain in this regard. And Ingersoll-Rand believes that we have not provided a reasonable justification for implementing NO_x aftertreatment in nonroad applications by 2011 and have not included any evidence in the record that demonstrates that NO_x adsorbers have been applied successfully to a nonroad engine. They believe that we should conduct a more thorough review before establishing a timetable for NO_x emission standards.

SBA Office of Advocacy further commented that we should maintain our position of not requiring NO_x aftertreatment devices such as adsorbers on small horsepower engines or equipment until such a requirement can be shown to be feasible, cost-effective, and beneficial.

Letters:
Associated General Contractors of America, OAR-2003-0012-0791 p. 8-9
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 13
Ingersoll-Rand, OAR-2003-0012-0504 p. 11
U.S. Small Business Administration Office of Advocacy, OAR-2003-0012-0815 - 0818 p. 8

Our Response:

We agree with commenters that given 15 ppm sulfur diesel fuel, the NOx adsorber technology can provide substantial reductions in NOx emissions consistent with the emission standards we have set for engines >75 hp. We have made a modification from our proposal regarding the NOx emission standards for nonroad engines >750 horsepower as described in Preamble Section II.A.4. We appreciate the comments regarding the potential feasibility of urea SCR technology to reduce NOx from nonroad diesel engines. In fact, such systems are available today from Caterpillar for some genset applications. As we describe in Preamble Section II.B, urea SCR systems have a unique burden to demonstrate that urea will be provided in-use to realize the desired NOx reductions. In order to certify a urea SCR system, an engine manufacturer would need to show that urea was readily available (i.e., address the urea infrastructure need) and further to show that the end-user would indeed add the needed urea (i.e., demonstrate some means to guarantee user compliance). We do believe that some nonroad diesel engines, such as those used in large nonroad gensets, may be able to make such demonstrations in the timeframe of the Tier 4 program.

We agree further, that exhaust gas recirculation (EGR) can play an important role in a NOx reduction program and can enable substantial NOx reductions as detailed in our recent Highway Diesel Progress Report 2 and the final RIA for the HD 2004 program. As described in Preamble Section II.A, we are finalizing a 2011Tier 4 NOx standard for mobile machines greater than 750 hp based on the use of cooled EGR or other equally effective NOx control technologies.

We appreciate the comments regarding Lean NOx catalyst technologies and the demonstrated potential of this technology to reduce NOx emissions from nonroad diesel engines. We have not premised any of the Tier 4 emission standards on this technology, but recognize that it could provide yet another option for nonroad diesel engine manufacturers to meet the Tier 4 emission standards.

We agree with the commenters that note the lack of ram-air for most nonroad diesel equipment and as we state in the response to comment 3.2.1.2, we have taken this into account in setting the emission standard levels in Tier 4 as we did for the Tier 2/3 program.

We appreciate the commenters who noted that the NOx adsorber technology has not today been widely applied to nonroad diesel engines. However, we disagree with the assertion that the technology path between now and 2011 is too unclear for us to set Tier 4 emission standards for engines above 75 hp and below 750 hp based on the performance of this technology. As described in our recent Highway Diesel Progress Review Report 2, there has been substantial progress to develop the NOx adsorber technology, to demonstrate its durability, and to introduce NOx adsorber equipped diesel engines into the light-duty diesel market in Europe and the light heavy-duty diesel market in Japan. Further, we have given particular consideration to the unique operating in-use operating cycles and more importantly to the regulatory test cycles for nonroad equipment as detailed extensively in Chapter 4.1 of the RIA. There we show that the NOx adsorber technology is well matched to nonroad diesel engine operating cycles and further document the means and technologies available to better match engine operation to NOx adsorber performance. The NOx adsorber based technology path for Tier 4 is well grounded in the on-highway diesel program for 2007 and is clearly defined in Chapter 4.1 of the RIA. There is more than adequate evidence for the Agency to reach a conclusion that the technology will be generally available and can be applied to 75-750 hp nonroad diesel engines and equipment, as well as >750 hp generator sets, by 2011.

3.2.3.2 Advanced NO_x Aftertreatment Systems on Large Nonroad Engines (over 750 hp)

What Commenters Said:

EMA commented that advanced NO_x aftertreatment systems may not be available for use on large nonroad engines (i.e. over 750 hp). While NO_x adsorber development is underway for on-highway engines, they believe that various basic limitations and technology hurdles have not been addressed. EMA also noted that there are significant additional challenges for engines greater than 750 hp, including the scalability of NO_x aftertreatment hardware and the complexity of the regeneration systems. They added that the size and durability concerns associated with PM filters also apply equally to NO_x adsorbers.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 20

Our Response:

While we do believe it may be possible to apply the NOx adsorber technology broadly to diesel engines above 750 hp, we recognize that there are additional uncertainties for mobile machines in this largest horsepower category and therefore we have decided not to set a NOx adsorber based emission standard for nonroad mobile machine diesel engines above 750 hp as described in Preamble Section II.A. We are setting a stringent (aftertreatment-based) Tier 4 emission standard for nonroad generator set engines above 750 hp as described in Preamble Sections II.A and II.B.

3.2.3.3 SCR

What Commenters Said:

CNH and Euromot commented that we should recognize SCR as an important alternative to the NO_x adsorber and we should not dismiss the feasibility based on the potential for tampering. Euromot believes that the problem of empty urea tanks can be solved by appropriate sensors for many types of machinery. If the sensors detect an empty tank or a tank only filled with water, the power of the engine could be significantly reduced, so that the operator is forced to replenish the tank. They stated that SCR has advantages over the NO_x adsorber in terms of cost, fuel consumption and CO_2 emissions. They believe that the urea price estimated by us is far too high, and that a more realistic estimate combined with the fact that the high catalyst volumes and precious metal loading of NO_x adsorbers results in significantly higher catalyst hardware costs, would show that SCR is less costly in comparison. Aftertreatment and EGR systems are generally sensitive to potential tampering and this is not considered to be a problem inherent to SCR. Euromot believes that we should establish certification requirements for SCR systems that are equivalent to other aftertreatment systems using additives for proper operation.

CNH also commented that SCR provides superior engine fuel efficiency and requires less vehicle cooling than NO_x adsorbers and a media volume of 2 times engine displacement. And further, that this technology is being developed for on-highway trucks in Europe, but in order to be acceptable for the U.S. market, an infrastructure in the US is required as well as the adoption of SCR by several engine manufacturers.

Letters:
Euromot, OAR-2003-0012-0822, 0823 p. 5
CNH Global, OAR-2003-0012-0819 p. 4

Our Response:

We do not dispute that urea SCR can be an effective means for NOx control provided that urea is readily available (i.e., urea infrastructure is addressed), provided that appropriate mechanisms are in place to ensure the urea tank is filled in-use and provided 15 ppm sulfur diesel fuel to protect oxidation function and prevent excessive PM emissions. The commenters suggested several mechanisms that may be effective as part of an overall solution to address end-user compliance. However, we do not believe urea SCR can be generally available by 2011 due to the lack of a urea infrastructure and therefore we are not predicating the Tier 4 emission standards on performance of this technology. This in no way precludes a manufacturer from using urea SCR to comply with the Tier 4 emission standards provided the engine manufacturer can make a demonstration that the urea will be readily available and that adequate mechanisms will be in place to ensure that the needed urea is always added.

We have not made an estimate of the cost for a urea SCR catalyst system nor for the cost to distribute urea broadly. The commenter's mention of an EPA cost estimate for urea is apparently referring to a recent Department of Energy funded study investigating the cost for a urea infrastructure. However, if the commenter is correct that the urea SCR technology is cheaper than the approach EPA has estimated in the Tier 4 program, and further, if the solutions suggested by the commenter to address urea compliance prove to be adequate, this would not change any decisions in the Tier 4 program but only reduce its cost.

3.2.3.4 Issues Associated with NO_x Control Technologies

What Commenters Said:

CNH commented that we should acknowledge certain challenges associated with NOx control technologies. They believe that substantial vehicle and systems development is required for the adoption of NO_x adsorber technology, which requires a media volume of 2 times engine displacement to achieve a 90 percent reduction. CNH added that there have been some driveability problems during regeneration with this technology as applied to light duty automotive engines, and there may also be issues with reduced durability for high load factors and efficiency deterioration after several thousand hours of use. In regard to the combined packaging of a diesel particulate filter and NO_x after-treatment, CNH believes that this will require a significant amount of space with a total after-treatment package volume of 6 to 8 times engine displacement. They stated that packaging must be at least 1 inch larger in diameter than the media volume for suitable insulation wrap and crush space to prevent substrate damage from accidental impact. This volume also includes space required for suitable transition sections for exhaust expansion into media then contraction back to the outlet pipe. Finally, they stated, exhaust piping volumes would be in addition to after-treatment package volume.

<u>Letters:</u>
CNH Global, OAR-2003-0012-0819 p. 4

Our Response:

We appreciate the commenter's concerns regarding the application of the NOx adsorber technology to nonroad diesel engines, and we have given specific consideration to the issues in setting the standard level and timing of the Tier 4 standards for NOx. For additional discussion of the packaging issue please see the response to comment 3.2.1.2. For additional discussion of the reduction potential of the NOx adsorber technology in order to achieve a 90 percent reduction over the regulated test cycles see RIA Chapter 4.1. Lastly, for the most up-to-date information on the substantial demonstrated progress to apply NOx adsorbers to diesel engines see the recently published Highway Diesel Progress Review Report 2.

3.2.4 HC Control

What Commenters Said:

No comments were received on this issue during the public comment period.

3.2.5 CO Control

What Commenters Said:

EMA commented that the proposed CO limit will complicate development efforts and could limit technology choices. They believe that the technologies that will be used to implement the necessary aftertreatment and regeneration systems to comply with the Tier 4 standards are largely unknown at the current time. EMA also added that the proposed CO limit, along with the NTE and other testing requirements, may constrain the technology that can be applied to aftertreatment. They offered the example of regeneration of the exhaust filter may cause high CO for limited periods of time when the carbon is being burned off. In addition, they believe that regeneration as a component of NO_x adsorber systems is likely to increase CO emissions during regeneration events. (Also, see related discussion under Issue 3.1.1.)

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 15

Our Response:

We are not requiring an additional level of CO control in this rulemaking, although the existing CO standards will now also apply for the new test procedures. The standard levels listed in the regulatory tables along with the new Tier 4 standards are the same as the part 89 previously applicable.

We disagree with the contention that the technologies for Tier 4 are unknown and that our existing (unchanged in Tier 4) CO standards may restrict the use of some emission control technologies. We do recognize that under certain circumstances of regeneration, emissions can be slightly increased over the normal level. However, we allow for the averaging of those emissions over the extended period between regeneration events in order to accurately account for their impact (see 40 CFR §1039.525).

Regarding the new test procedures, while transient operation can increase CO emissions as estimated in EPA's nonroad model, the additional CO control realized from the addition of an oxidation catalyst or CDPF as needed to meet the PM standards, will more than offset any emission increase.

Diesel oxidation catalysts and CDPFs can reduce CO emissions by more than 80 percent. Even if CO emissions were to double from their Tier 3 levels under transient conditions, an 80 percent reduction from that new higher baseline would result in emissions that are 60% below the Tier 3 level (i.e., if the baseline is 1 and is doubled to 2, and then reduced by 80% to 0.4, the result is 60% lower than the original level of 1). Given that the standard level is unchanged from Tier 2/3, we do not believe that additional control technologies beyond the technologies already necessary to meet the Tier 4 PM standards, will be required to meet the CO standards even with the new emission test cycles.

The oxidation technologies we expect will be employed to control PM emissions (DOCs and CDPFs) are highly effective at reducing CO emissions (see RIA Chapter 4.1). Testing of combined NOx adsorber and PM filter systems as we would expect to see used in nonroad diesel equipment has demonstrated very low CO emissions (see EPA's recent Highway Diesel Progress Review Report 2). In general, the Tier 4 program will lead to a reduction in CO emissions over the Tier 3 baseline, not an increase as implied in the comments. Further, because of our averaging provisions for regeneration emissions, those lower overall levels will be reflected in the compliance emission level (i.e., a manufacturer is not unduly penalized by slightly higher emissions during regeneration).

3.2.6 Air Toxics Control

What Commenters Said:

No comments were received on this issue during the public comment period.

3.3 Engines > 750 hp

3.3.1 Feasibility

What Commenters Said:

<u>The Standards are Feasible</u>

Environmental Defense and MECA believe that our proposed standards for engines greater than 750 hp are technologically feasible and that the challenges associated with integrating emission control technology on large engines can be met. They commented that DOCs, DPFs and SCR have been installed successfully on large engines such as mining equipment, switcher locomotives, commercial marine engines, and/or stationary IC engines. They believe that the larger size of the vehicles on which these engines are used is typically beneficial when integrating engine/emission control technology for optimum performance, and state that the cost of meeting the standards will be a relatively small portion of the overall engine and equipment costs. Both commenters believe that the proposed timeframe provides adequate time for the emissions control industry to develop, engineer, and make commercially available the necessary emission control products.

<u>Letters:</u>
Environmental Defense, OAR-2003-0012-0821 p. 9
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 9

<u>*The Standards Are Not Feasible*</u>

A number of commenters (Caterpillar, Komatsu, Murphy, EMA, NMA) believe that requiring the use of aftertreatment technologies for nonroad diesel engines greater than 750 hp, which are typically used in construction and earthmoving, is not feasible and would render the equipment impractical and too costly for the end-user.

Caterpillar, Komatsu, and Murphy added that the requirement for using a transient test cycle for these engines would require a great deal of development work along with a significant capital investment in additional test cells. Therefore, they stated, we should revise the proposed rule to regulate this engine category beginning in 2012 with the split family emission levels certified using the steady state test. (See additional discussion under Issues 7.5.1 and 3.1.2.)

EMA commented that problems associated with applying on-highway-like technologies to nonroad engines are exacerbated when nonroad engines fall outside the typical size range of highway engines. For nonroad engines greater than 560 kW or 750 hp, there are no corollary on-highway engines from which aftertreatment systems and technologies can be readily transferred. They stated that the power range of this single category is over nine times larger than the entire power range for on-highway engines, these engines require multiple cylinders often arranged in a "V" configuration, and multi-stage turbocharging with dual exhaust is common for these engines. EMA provided significant additional discussion on this issue with respect to the design and space constraints, durability concerns, and other issues specific to PM filters and NO_x aftertreatment systems. (See additional related discussion below (under this issue) and under Issues 3.2.1.1 and 3.2.1.2.)

EMA also believes that developing aftertreatment systems that can meet the design and space requirements for large nonroad applications will be a challenge. They stated that the control of exhaust backpressure is a major design constraint for manufacturers, and with the higher exhaust flows of large nonroad engines, this constraint becomes an even more significant issue and designing additional "manifolding" of exhaust systems to allow for multiple aftertreatment devices is not a practical solution for manufacturers. Increasing the size of the PM filter to alleviate the backpressure concerns would be limited since even a larger assembly of filters do not meet the requirements of large nonroad engines without additional manifolding. Manifolding aftertreatment devices also causes significant installation issues since the required use of manifolding multiple exhaust and aftertreatment systems exacerbates the space constraint problem.

EMA also commented on concerns with durability, which they will be a significant issue when considering the installation of controls on larger nonroad engines. They stated that engines placed into the largest types of nonroad equipment are often used in earth-moving or mining applications, and that these engines are exposed to much more punishing environments than on-highway engines. They added that engines and equipment operating in large mines are of particular concern to manufacturers, as G-loads experienced by this equipment exceed that of most smaller pieces of equipment and the larger size and weight of aftertreatment systems required for this equipment will impact the durability of such systems. Further, EMA stated, leaks are also a risk for filters assembled from smaller pieces; the efficiency of larger, multi-piece filters can be much less than a single piece unit due to the cracking that can develop quickly in use. EMA provided additional discussion on the issue of durability and practicality for the largest nonroad engines, particularly with respect to complications associated with the use of multiple parallel PM filters. (See related discussion under Issue 3.2.1.1.)

NMA commented that the highway sector is unlikely to provide any useful information regarding the application of emissions control technology to larger engines. They believe that the application of these technologies to engines and equipment used in the mining industry will be difficult, the market is small, and significant capital investment will be required leading to a substantial cost burden for mining operators. Therefore, NMA believes that these engines should be exempt from the Tier 4 rule. (See additional discussion under Issue 3.1.2)

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 17-20
Komatsu, OAR-2003-0012-0455 - 0457 p. 2-3
Murphy Oil, OAR-2003-0012-0212 p. 4
National Mining Association, OAR-2003-0012-0510 p. 2
New York Public Hearing, A-2001-28, IV-D-05 [Caterpillar p. 77]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [Caterpillar p. 83]
Chicago Public Hearing, A-2001-28, IV-D-06 [Caterpillar p. 61]

Our Response:

While we do believe it may be possible to apply the NOx adsorber technology broadly to diesel engines above 750 hp as some of the commenters have suggested, we recognize that there are additional uncertainties for mobile machines in this largest horsepower category and therefore we have decided not to set a NOx adsorber based emission standard for nonroad mobile machine diesel engines above 750 hp as described in Preamble Section II.A. We are setting a stringent Tier 4 emission standard for genset mobile machines above 750 hp as described in Preamble Sections II.A and II.B.

We disagree with the commenters who suggest that advanced emission control technologies are too expensive and impractical for large earthmoving or other applications that use nonroad diesel engines above 750 hp. As the commenters from MECA and Environmental Defense accurately note, large physical size can be beneficial in a number of ways including for temperature management due to the improved volume to surface area ratio for large catalyst systems. Additionally, we agree as was clear from the analyses in the draft RIA, that the cost of emission control systems for engines greater than 750 hp represents only a small portion of the overall cost for large nonroad diesel equipment.

We do recognize that there are some specific challenges with respect to large >750 hp nonroad diesel engines, especially for large earthmoving mobile machines as noted by the commenter. We have taken specific consideration of this in setting the PM emission standards for genset diesel engines above 750 hp and nonroad mobile machine diesel engines above 750 hp as described in Preamble Sections II.A and II.B, and also in determining the appropriate test cycles applicable to these engines, as described in section III.F of the preamble.

We do not believe that NMA's preferred approach of exempting its engines from Tier 4 standards is permissible. Our detailed response is found at section 12.6.2.2.7 of the Draft RIA, and is briefly summarized here. Mining engines have already been held to be properly subject to regulation under section 213, Engine Manufacturers Ass'n v. EPA, 88 F. 3d 1075, 1098 (D.C. Cir. 1996), and we are finding in this rule that further reduction in PM and NOx emission from these engines is technically feasible at reasonable cost. These engines emit very high volumes of PM and NOx, notwithstanding that they are sold in relatively small numbers. We have taken into account these engines' long design cycle and low annual sales volume in the long lead time provided in the rule, which includes the ABT and equipment manufacturer flexibility programs.

We note further, however, that we have made certain changes in the proposed standards for these engines. As noted in other comment responses and in section II.A.4 of the Preamble, while retaining aftertreatment-based standards for PM for all greater than 750 hp engines, we are increasing the level of those standards over those proposed based on technical concerns. We also are deferring a decision on whether to adopt an aftertreatment-based standard for NOx from greater than 750 hp engines in mobile machines, which would include aboveground mining equipment.

See also our response to comment 3.2.1.2.

3.3.2 Cost and Design Issues

What Commenters Said:

EMA and Cummins commented that resource constraints may limit the design and development of aftertreatment systems for the high-cost, low volume market represented by nonroad engines over 750 hp. EMA further added that there are a large number of engine platforms in the over 750 hp category, which exacerbates the problems associated with these high-cost and low-volume engines. They believe that aftertreatment developers necessarily will be focused on the challenges of designing and improving systems for the much higher volume on-highway products in the lower horsepower ranges. However, they stated, the sales volume of large nonroad aftertreatment systems will be very low, while the technical challenges will be extremely high and costly. EMA modeling indicates that nonroad engines greater than 750 hp (560 kW) are responsible for less than 5 percent of the total nonroad inventory. Therefore, they believe that an alternative approach that would allow for additional flexibility would not significantly affect overall emission reductions from nonroad engines, and that we should consider staggering the introduction dates for these large nonroad engines.

Cummins commented that we should have accounted for the increased technical challenges of transferring technologies developed for on-highway products to nonroad engines outside the on-highway power range. They provided additional discussion on this issue and provides a chart showing that many larger engines are outside the scope of the on-highway power range noting that this chart illustrates the relatively narrow scope of the on-highway rule as compared to the nonroad rule in terms of the number of platforms impacted as well as the power range covered.

Letters:
Cummins, Inc., OAR-2003-0012-0650 p. 2-3
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 20-21

Our Response:

As we describe in our responses to comments 3.2.1.2 and 3.3.1, we have made a number of specific changes from our proposal design to address technical challenges and other aspects of nonroad diesel engines > 750 hp. Similarly, as described in Preamble Section II.A, we have given consideration to the relative sales volumes for these engines in developing an implementation schedule that is appropriate for engines in this category. Lastly, based in part on comments from Cummins, we have further refined our estimate of the research and development costs for nonroad diesel engines in order to estimate those costs more precisely. The change we have made (described in Preamble Section VI and in Response to Comment 5.3.1.3) increases our estimates of the cost for engine manufacturers >750 hp. Our cost estimates accurately reflect the cost for this category and the changes we have made to our implementation schedule and the emission standards address the unique issues for engines greater than 750 hp.

3.4 75 to 750 hp Engines

What Commenters Said:

MECA commented that our proposed standards for engines in the 75 to 750 hp category are technologically feasible. (Also see Issues 3.2.1, 3.2.1.1 and 3.2.1.2 for a general discussion of MECA's comments on feasibility.)

NESCAUM commented that our proposed NOx standards for engines in the 75 to 750 hp category are technologically feasible. NESCAUM added that manufacturers are developing advanced strategies such as NO_x adsorbers and lean NO_x traps to meet the 2007 and 2010 on-highway requirements which will facilitate the effective application of these technologies to nonroad engines in 2011. In addition, they stated, application of EGR in nonroad engines will help manufacturers in reaching the 0.3 g/bhp-hr standard for NO_x. EGR technology is the most likely strategy for on-highway engines to meet the 2007 standards and is being considered by NESCAUM states and others as a viable technology for retrofit application for existing on-highway vehicles and nonroad equipment. NESCAUM believes that the proposal provides manufacturers of nonroad engines ample lead time to integrate EGR, adsorber, and other technologies into new diesel engines.

NESCAUM further stated that the proposed PM standards for engines between 25 hp and 750 hp are feasible, as technologies to reduce diesel PM, such as diesel particulate filters and diesel oxidation catalysts are commercially available today. They added that DOCs and particulate filters have been installed on vehicles and equipment, and approximately 200 pieces of nonroad equipment have been retrofitted in the NESCAUM states with oxidation catalysts over the last 3 years at the Big Dig, the World Trade Center, the Connecticut I95 project, and other sites. NESCAUM offered the example of PM filters installed as part of a NESCAUM pilot retrofit project of nonroad equipment reduced nonroad engine PM by more than 90 percent. This project demonstrates the feasibility of installing filters on new equipment, since this is generally less difficult than retrofit installations. They believe that the proposal provides ample time to integrate PM filter technology into nonroad equipment.

Letters:
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 9
NESCAUM, OAR-2003-0012-0659 p. 4-6

Our Response:

We agree with commenters that there is substantial evidence to show that the emission standards for nonroad diesel engines between 75 hp and 750 hp are feasible. Further, as the commenters note, this evidence includes the use of advanced emission control technologies today on nonroad diesel engines.

3.5 Under 75 hp Engines

What Commenters Said:

MECA and NY DEC commented that there are available technologies to control emissions from smaller nonroad engines. MECA cited two examples of integrating emission control technologies on very small engines (25 hp or less) which include the successful design and installation of over 15 million catalysts worldwide on small motorcycles and mopeds, and the installation of over one million catalyst devices on a variety of lawn and garden equipment including chainsaws, trimmers, and lawn mowers in the U.S. and Europe. They believe that the same type of innovations in design and packaging can be applied to even the smallest-sized nonroad diesel engines. In addition, they stated, diesel oxidation catalysts are available for smaller engines, which will reduce PM and hydrocarbon emissions.

In regards to future emissions control technology, MECA also commented that technologies such as lean NO_x catalysts (capable of reducing NO_x by up to 25 percent or more) and lower efficiency DPFs (capable of reducing PM by 50 to 60 percent) may emerge in the near future for the smaller engines. They believe that for nonroad diesel engines in the 25 to 75 hp range, cost-effective NO_x control strategies (such as lean NO_x catalyst technology or possibly low-pressure EGR) will emerge. MECA believes that we should tighten the standards for these engines as these technologies become more viable.

NY DEC further commented that one possible way for smaller horsepower engines to reduce emissions is to have catalytic converters and/or particulate matter filters added to assist in emission controls. They added that gasoline engines as small as homeowner lawnmowers are now starting to carry catalytic converters for emission control. They believe that the ability to attach catalytic converters to small gasoline engines demonstrates that manufacturers' concerns about space issues with small diesel engines can be accommodated.

<u>Letters:</u>
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 2-5
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 7
Los Angeles Public Hearing, A-2001-28, IV-D-07 [MECA p. 58]

EMA does not believe that the standards will be feasible for smaller engines. They commented that the proposed RIA suggests that very small engines (19 KW to 37 kW) may be able to meet the standards through the use of currently identified systems that use combusted fuel or electric heat for PM filter regeneration. However, they believe that those systems are complex, expensive, unreliable and unproven. They added that the proposed NO_x standards call for EGR-forcing NO_x reduction, which adds further to the cost and complexity of the requirements for these smaller engines. EMA believes that the proposed standards would require the invention of a duty-cycle-independent PM filter regeneration system that is cost effective and durable; however, manufacturers know of no such invention that exists or that is under development.

<u>Letters:</u>
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 24-25, 111

Ingersoll-Rand and Lister Petter believe that the proposed standards may be difficult to meet for the manufacturers of smaller engines. Ingersoll-Rand commented that some nonroad engine manufacturers, particularly those whose expertise involves manufacturing engines below 100 hp, do not manufacture highway engines. They cited the example of the two suppliers who provide 80 percent of the engines purchased by Ingersoll-Rand (Kubota and Yanmar) lack a significant presence in the highway sector yet will be required to comply with the nonroad standards without the benefit of experience from highway engines.

Lister Petter added that the availability of systems for the lower power categories where volumes are lower and the number of applications is larger, is a major concern. They believe that the aftertreatment industry will be focused on the largest customers and the largest markets and are concerned that the necessary systems may not be available for the lower power categories in time to meet the proposed Tier 4 introduction dates.

Letters:
Ingersoll-Rand, OAR-2003-0012-0504 p. 7
Lister Petter, OAR-2003-0012-0155 p. 2

Our Response:

While we agree with commenters that note the importance of controlling emission from these engines and the availability of technologies to do so, we also recognize the important technical issues that must be addressed in order to apply those technologies. We have given consideration to these issues in setting both the level of the emission standards and the timing of the emission standards for engines in this category as described in Preamble Section II.A and II.B. See also response to comments 3.2.1.2 and 3.2.2.1.

As described in the RIA, we carefully analyzed the feasibility of our new standards for engines under 75 hp, and determined that the standards being adopted are feasible. See RIA 4.1.4.3 and 4.1.5.3. Regarding the appropriateness of controls for these engines and the commenters concern regarding issues such as the relative cost effectiveness of emission standards for these engines, EPA specifically investigated this issue at proposal through an alternative options analysis documented in the Draft RIA, Chapter 12 (see Options 5a and 5b). That analysis clearly shows, that the cost of control for these engines (both NOx control with EGR and PM control) is not excessive given consideration to the substantial emission reductions and the benefits accrued from those reductions. We have given specific consideration to the fact that some nonroad engine manufacturers, including the two cited in the comment, make only nonroad diesel engines in estimating the cost of compliance with the Tier 4 program (See RIA Chapter 6). See also response to comment 5.3.1.4. While we have accounted for higher research and development costs for these manufacturers, we do not believe that their lack of on-highway experience will preclude them from being able to develop the needed technology. Prior to the 2007 regulations, on-highway engine manufacturers would not have extensive experience with these technologies either.

We disagree with the commenter suggesting that the lower horsepower markets will be under-served by the emission control development companies. Sales volumes for small engines exceed those for larger engines and are more similar in size to current automotive technologies than are typical heavy-duty diesel engines. Hence, the small engine power category benefits significantly from developments made for the high volume diesel passenger car market. Also, it is cheaper and easier to manufacturer small ceramic catalyst components than large ceramic catalyst components which can "sag" under their own weight prior to firing in the kiln.

Lastly as described in Preamble Section VIII.A, we are committing to conduct a technology review for engines in the horsepower categories below 75 hp in part to confirm that technologies are progressing as we expect.

3.6 Crankcase Emission Requirements

What Commenters Said:

Environmental Defense, MECA, NY DEC, and NESCAUM support the proposed crankcase emission requirements. MECA added that the proposed crankcase emission standard for nonroad diesel engines can be achieved in a cost effective manner within the lead time provided, if 15 ppm diesel fuel is available. Environmental Defense and the NY DEC commented that we should maintain the provisions for crankcase emissions, as these emissions contain significant quantities of toxins that previously have been uncontrolled, and with reductions in other areas, they assume even greater significance. Environmental Defense agrees that EPA should eliminate the exception for turbocharged nonroad diesel engines starting in the same model year that the Tier 4 standard first applies.

MECA and NESCAUM further stated that the approach developed for highway engines is an approach that can be used for nonroad engines as well. Concerns about fouling of the turbocharger and aftercooler caused EPA to make an exception for turbocharged heavy-duty diesel engines. They offered a solution to this problem of using a multi-stage filter designed to collect, coalesce, and return the emitted lube oil to the engine's sump. Filtered gases are returned to the intake system, balancing the differential pressures involved. The commenters believe that these systems have the capability to virtually eliminate crankcase emissions. They added that the technology is currently being used in Europe and will be used on highway diesel heavy-duty engines in the U.S. beginning in 2007.

Letters:
Environmental Defense, OAR-2003-0012-0821 p. 9-10
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 5
NESCAUM, OAR-2003-0012-0659 p. 6
New York Public Hearing, A-2001-28, IV-D-05 [MECA p. 115; NY DEC p. 12]

What Commenters Said:

DDC and EMA commented that the proposed crankcase requirement could have an adverse effect on the ability of nonroad engines to meet the tier 4 standards. They do not believe that it will be technologically feasible to achieve the proposed Tier 4 NO_x and PM emission standards for the full useful life of a nonroad engine in the face of a requirement to recirculate crankcase emissions. They added that nonroad engine manufacturers also face the additional challenge of designing blowby filtration systems which will operate at high angularity, a consequence of the fact that due to unlevel ground, nonroad machines are often required to operate in orientations with high angles of pitch and roll, often for extended periods of operation. The commenters believe that we should simply require manufacturers to combine crankcase emissions with exhaust emissions for test purposes and for demonstrating compliance with applicable emission standards during certification and verification testing. If this approach is taken, they stated, EPA should show that the standards are feasible when crankcase emissions are accounted for in this way and should develop and promulgate standardized measurement procedures. Further, EMA cited to the following concerns in this context that were previously raised in response to the 2007 on-highway rule: 1) lost efficiency when routing blowby gases into the engine intake system due to fouling of charge air coolers and other air system components; 2) accelerated poisoning of aftertreatment systems due to the high sulfur content of lubricating oil; 3) feasibility of meeting the proposed standards over the useful life of the engine; and 4) the need for manufacturers to be able to vent to gases into the atmosphere as long as emissions are accounted for. (See, EMA Statement on 2007 On-Highway Rule, p. 52-53.)

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 6
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 50-51, 112

Our Response:

We agree with commenters that note the importance of controlling emission from diesel engine crankcases and the ready availability of systems to control these emissions.

Our feasibility analysis in the NPRM was based on the use of closed crankcase technologies designed to inertially separate oil-aerosol and filter crankcase gases before sending the cleaned gas to the engine intake for combustion and returning the oil removed from the gases to the engine crankcase. These systems are proven in use, are commercially available (in some cases by subsidiaries of EMA member companies) and the use of this technology to eliminate crankcase emissions is acceptable to demonstrate compliance.

The use of this type of system:

- prevents fouling of charge-air cooling systems by inertially removing the oil aerosol

- routes the sulfur containing oil back to the crankcase, thus preventing its introduction into the combustion system and subsequent effects on exhaust aftertreatment.

We acknowledge as one commenter states that closed crankcase systems must consider angularity (the degree to which the engine may be tipped in use), but disagree with the implication that such an issue would make the closed crankcase requirement infeasible. Currently naturally aspirated nonroad diesel engines have closed crankcase systems that work in the wide range of typical nonroad engine operation including high angularity. Similar solutions to address this particular issue (essentially careful geometric design) will be effective for turbocharged engines as well.

The option to vent crankcase emissions into the exhaust or to continue to vent crankcase emissions to the atmosphere provided the total emissions including tailpipe and crankcase emissions do not exceed the standards are provided as alternate solutions that are clearly effective to control emissions (i.e., if the emissions are measured and are below the standard they are adequately controlled). See Preamble Sections II.A and II.B for additional discussion of our closed crankcase requirements.

3.7 Sulfur's Effect on Diesel Control Devices

What Commenters Said:

EMA commented that oxidation catalysts reduce PM emissions, as well as VOCs and CO, and are durable, with little or no deterioration in emissions over time. However, they stated, in 500 ppm diesel fuel, the sulfur is converted to sulfate particulate, offsetting the reductions in organic PM. Ultra low sulfur (15 ppm or lower) fuel minimizes the sulfate conversion problem and enables the use of more active catalysts, allowing for greater organic PM reductions. They further believe that even though there are numerous problems with the use of oxidation catalysts in nonroad engines and equipment applications and the use of this technology cannot achieve the levels of PM reductions in the Tier 4 proposal, the availability of 15 ppm sulfur fuel will enable and encourage the development of more efficient oxidation catalysts.

EMA also added that PM filter technology can be very effective at reducing PM emissions to extremely low levels, provided ultra low sulfur fuel is available. The pre-catalyst converts fuel sulfur to sulfate particulate which is not trapped by the downstream filter and which has a significant effect on tailpipe PM emission levels. Approximately 1 to 3 percent of fuel sulfur converts to sulfate during the engine combustion process, which is emitted as PM and collected and measured as part of the PM test procedure requirements. The balance of fuel sulfur is emitted as gaseous SO_2 and, even though it is not measured as tailpipe PM, the majority is later converted to sulfate in the atmosphere. They stated that engine manufacturers expect that the use of advanced catalysts in PM filter systems will increase the sulfate conversion rate of emission control systems to 40 percent or more -- the increased sulfate conversion rate of such emission control technologies represents a significant portion of the PM emissions from nonroad engines. Further, they stated, for PM filters sulfur in the fuel can inhibit the NO to NO2 conversion process causing the regeneration light-off temperature to increase outside the normal exhaust temperature range, with the result that the filter can become susceptible to plugging. They added that this is particularly critical for light-duty applications, which generally operate at lighter loads and lower exhaust temperatures, and for heavy-duty applications that operate extensively at light loads and low speeds.

MECA commented that sulfur affects precious metal catalyst-based diesel particulate filter performance by inhibiting the performance of catalytic materials upstream of or on the filter, which adversely affects the reduction of emissions and the regeneration capability of the filter. They added that sulfur also competes with chemical reactions intended to reduce pollutant emissions and creates PM through catalytic sulfate formation. MECA believes that diesel fuel containing less than 15 ppm sulfur is required to ensure maximum emission control performance. Further, MECA commented that even though DOC technology will function effectively with less than 500 ppm fuel, the availability of 15 ppm fuel will improve overall catalyst PM control efficiency by reducing the sulfate production and will enable the use of more active catalyst formulations that could provide greater reductions in both toxic HC and the soluble organic fraction (SOF) of the PM emissions.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 6-7
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 9-10

What Commenters Said:

EMA and MECA commented that NO_x adsorbers are particularly sensitive to the presence of sulfur in diesel fuel, as sulfur converts to sulfate and the sulfate consumes the storage sites needed for effective NO_x adsorption. They added that, due to sulfur's effect as a cumulative poison in NO_x adsorbers, such technology is not usable with current diesel fuel sulfur levels. MECA also commented that while a sulfur regeneration mode or desulfurization cycle will be necessary, the frequency of desulfurization must be minimized to avoid substantial fuel economy penalties and degradation of the NO_x adsorber performance. Further, EMA noted that a recent research program in which EMA participated, evaluated various sulfur-sensitive technologies and obtained data on the sulfate conversion levels over a broad range of highway engine operating conditions. This program showed that there are no sulfur-tolerant aftertreatment technologies capable of meeting future emission standards and technologies such as NO_x adsorbers, are so sensitive to fuel sulfur that they are judged to be infeasible without the use of ultra-low sulfur fuel. They referenced "Statement of the EMA," p 10-12, August 14, 2000, which provides additional details on this issue.

Lastly, MECA commented that the effectiveness of SCR and lean NO_x catalyst technologies would benefit from the use of less than 15 ppm sulfur diesel fuel in terms of improved emission control performance and minimization of the sulfate formation when precious metals are used.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 8
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 10

Our Response:

We agree with commenters that 15 ppm sulfur diesel fuel is necessary to ensure that advanced PM and NOx emission control technologies will be fully effective. See RIA Chapter 4.1.7 and Chapter III.A.7 of the HD 2007 RIA (EPA420-R-00-026) for detailed discussions of the effect of sulfur on NOx and PM control. These comments are consistent with EPA's analysis presented in the RIA.

3.8 Fuel Economy Impacts of the Proposal

What Commenters Said:

The Associated General Contractors of America (AGCA) commented that PM (as well as NOx) aftertreatment could require costly electronic components that currently are not included in the engine or equipment design in the smaller powerbands. AGCA stated that these electronics could affect engine performance, reduce fuel economy, reduce engine durability, and ultimately substantially increase the price of the equipment. The commenter also stated that some contractors have questioned whether the use of ULSD will result in reduced fuel economy. According to the DTF, AGCA commented, as refiners remove sulfur from diesel, fuel can have a slightly lower energy content. The impact likely will vary from refinery to refinery and from tank to tank, based on refinery operating conditions, equipment, feedstocks, and blendstocks.

Ingersoll-Rand commented that it believes customers will react unfavorably to cost increases from Tier 4, particularly when they will also encounter reduced durability, increased heat rejection, increased maintenance costs and lower fuel economy. The commenter also stated that it believes that the introduction of aftertreatment will impair performance and safety of small, compact equipment because of increased heat rejection, decreasing fuel economy, and larger engine configuration.

Letters:
Associated General Contractors of America, OAR-2003-0012-0791 p. 9 p. 15
Ingersoll-Rand, OAR-2003-0012-0504 p. 9-10

Our Response:

We agree with commenters that the application of some advanced emission control technologies can affect fuel economy, both positively and negatively. As discussed in RIA Chapter 6, we have made detailed estimates of the fuel economy impacts of the Tier 4 program. Additionally, the economic impact analysis described in RIA Chapter 10, gives consideration to any increased operating costs, including costs related to changes in fuel consumption. The commenters provided no data or other evidence to cause us to believe the estimates we have made are inappropriate regarding the impact of the Tier 4 emission standards on fuel economy. We disagree with the commenter noting a link to electronic controls and decreased fuel economy. In general, electronic controls provided improved fuel economy through better engine management and more precise controls. Significant end-user benefits are commonly realized with the application of electronic controls. Please see 3.2.1.2 above, for responses regarding the commenters' concerns about heat rejection and larger engine configuration.

3.9 2007 Technology Review

3.9.1 Support for Conducting a Technology Review

What Commenters Said:

John Deere commented that a timely and credible 2007 technical review is critical to assessing the ultimate feasibility of the proposal, particularly since developing cost-effective aftertreatment to engines as small as 19 kilowatts may be difficult. Deere, along with EMA and Euromot, believe that we should thoroughly analyze the cost-effectiveness (or lack thereof) of regeneration systems in the anticipated technology review to determine the feasibility of the proposed PM trap and EGR forcing standards for engines in the 19 to 37 kW range. They believe that we should use the technology review not only to review the standards and feasibility, but also to harmonize the standards with international protocols. The commenters also stated that there were numerous shortcomings to the 2001 review, which should not be repeated in this review; and they believe the 2007 review should be conducted by a panel that is completely independent of EPA. The commenters would like this review to include demonstration projects, establish clearly defined criteria for what constitutes a successful demonstration, and include specific focus on those issues that threaten alignment of emissions regulations between the U.S. and EU. Deere also provided additional discussion on each of these factors.

DDC and EMA commented that a technology review could be useful, however the specific parameters for the review process should be discussed and agreed upon well in advance. They believe that there should be agreement on: 1) a definitive process and timeline for the review, 2) the entity or group that should have overall responsibility for the review, 3) the ultimate work product that will result, 4) the scope of the review, and 5) agreement on the criteria to be applied in assessing potential modifications to the Tier 4 rule. EPA should initiate a consultative process to develop key parameters for the 2007 technology review.

Euromot commented that the technical review should focus on: 1) analyses of the application and use of aftertreatment systems on the type of engine and machinery; 2) the stringency of the NO_x standards using aftertreatment; 3) the standards for engine power categories subject to PM aftertreatment; 4) the application of the NRTC on the type of engine and machinery; and 5) engines both above and below the new power category split at 56 kW. They also noted that the Tier 4 rule covers a broader power range than the EU Directive and suggested that we postpone the regulation for engines below 19 kW and above 560 kW, carefully coordinate with the EU technical review on the need to regulate these engines, and agree to a common solution in order to avoid trade barriers.

CARB, MECA, and NESCAUM commented that they support the proposed 2007 technical review, but only if it also evaluates the feasibility of imposing more stringent standards. They added that many States believe that cost effective NO_x and PM control strategies such as lean NO_x catalysts will be available in the near future for engines smaller than 75 horsepower and possible diesel particulate filters for engines smaller than 25 horsepower. It was suggested by the commenters that the 2007 technical review should evaluate the availability of cost effective NO_x and PM controls with the lower horsepower rating ranges and modify the standards accordingly. And further, that we should consider the feasibility of setting tighter NO_x standards for these smaller engines in the 2012/2013 timeframe given the possibility that cost-effective NO_x control strategies, such as lean-NO_x catalysts, may emerge for these smaller engines. CARB noted generally that a scheduled 2007 technology review could be used to confirm the feasibility of more stringent standards for smaller engines.

WBRT commented that this review should be conducted to evaluate whether appropriate, cost-effective technology has been developed. To conduct this review, they believe that we should use an independent entity or "honest broker" that has the ability to provide a thorough evaluation of engine performance and the effectiveness of aftertreatment technologies.

AEM commented that there should be a government and industry sponsored pilot program to verify the transfer of advanced emission control technology to nonroad equipment, which would sponsor the build-up and in-field testing of at least one example piece of equipment in each of the Tier 4 power categories to determine the transferability of on-highway technologies. They added that the pilot program should address certain specific issues, such as tracking potential cost increases to nonroad equipment; evaluating the 56 to 75 kW (75 to 100 hp) equipment in terms of feasibility, cost-effectiveness, and the appropriateness of the 100 hp cutpoint; and determining the practicality of the emission limits proposed for the 25 hp and under category. AEM believes that a pilot program would be beneficial in acquiring some ‘real world’ data on aftertreatment transferability and cost impacts.

<u>Letters:</u>
Association of Equipment Manufacturers, OAR-2003-0012-0669, 0670 p. 5-6
Deere & Company, OAR-2003-0012-0692 p. 7-8
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 8
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 25, 101-102
Euromot, OAR-2003-0012-0822, 0823 p. 6, 8-9
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 2, 8, 12
Western Business Roundtable, OAR-2003-0012-0636 p. 2

New York Public Hearing, A-2001-28, IV-D-05 [CARB p. 143; Deere p. 53; NESCAUM p. 97]

Our Response:

Many commenters from a diversity of viewpoints expressed support for our conducting a technology review.

Regarding the need to coordinate the review with ongoing activities in Europe, the October 2003 amendments to the Directive that sets future nonroad diesel standards in the European Union would very closely align the EU program with our program in the Tier 4 timeframe.[15] Further enhancing prospects for close harmonization, the amended Directive would include plans for a future technical review: "There are still some uncertainties regarding the cost effectiveness of using after-treatment equipment to reduce emissions of particulate matter (PM) and of oxides of nitrogen (NOx). A technical review should be carried out before 31 December 2007 and, where appropriate, exemptions or delayed entry into force dates should be considered." We are greatly encouraged by the degree of harmonization achieved thus far, and, given our common interests, issues and planned timing, expect to work closely with Commission staff in carrying out the 2007 technology review, with an aim of preserving and enhancing harmonization of standards.

Regarding comments expressing interest in having the review conducted by an independent entity, although we plan and hope to have the active participation of all interested parties in the review process, assigning responsibility for the review to groups or individuals outside the Agency would be inappropriate. As the review would be closely tied to potential subsequent rulemaking action by the Agency, it is essential that it adequately cover the relevant issues. To ensure this, it is imperative that we retain overall responsibility for the review. We have not yet worked out process details for the review, but will do so at some later date.

3.9.2 Scope of the Technology Review

What Commenters Said:

ARTBA, AEM, and CEMA-CECE commented that we should verify that the evolving technologies that will be used to meet the proposed standards will perform as assumed when transferred from heavy-duty trucks to nonroad equipment. They believe that there are several issues that we should evaluate and address in a technology review. First, they stated, nonroad diesel regulations should be globally aligned, particularly with respect to the European Directive (97/68/EC Amendment or Stage IIIB). Second, NO_x aftertreatment controls may not be ready for application to nonroad engines given that the 2007 on-highway rule will not be fully implemented until 2010, only one year before the Tier 4 introduction date of 2011. Third, additional information is needed to assess the performance and feasibility of aftertreatment devices for small equipment between 19 and 37 kW, and standards should not be finalized for this category until additional information demonstrates the feasibility of the proposed standards. Fourth, OEMs with no on-highway product line have to rely on third parties for outsourcing

[15] Council of the European Union, "Proposal for a Directive of the European Parliament and of the Council amending Directive 97/68/EC", October 10, 2003.

their R&D and hardware procurement. Fifth, an on-highway counterpart may not exist for the smallest (< 100 hp) and largest (> 600 hp) engines. Sixth, nonroad engines experience a much wider duty cycle, which is not conducive to catalyst performance efficiency or the system regeneration cycles necessary to assure adequate reduction efficiency. Finally, they commented that for nonroad engines, the performance and durability of advanced emission controls will be affected by extremes of terrain, vibration, weather, dust and ambient variations.

AED, AGCA, CEMA-CEC, and CNH commented that the proposed technology review will review the progress of the aftertreatment technology and its appropriateness for adoption on the smaller machines. However, they believe that this scope is too narrow given the unknowns associated with this rulemaking. They believe that we should conduct a rigorous and more comprehensive review of the technology of emissions reduction strategies in 2007 and prior to the full implementation of the standards. The commenters suggested that we should assess the progress of: 1) manufacturers of diesel engines and emissions control systems in developing technology to reduce exhaust pollutants from all horsepower ranges, and 2) the fuels industry in developing and demonstrating technologies to effectively lower the sulfur level of highway diesel rule in order to evaluate the appropriateness of the nonroad standards. In addition, they believe that an essential element of the technology review should be the creation of a government/industry Pilot Program to gather information on technology transfer, performance, and incremental costs. CNH added that the technology review should be completed in conjunction with the EU.

Ingersoll-Rand commented that we should conduct a thorough review to determine whether the standards and timing of the Tier 4 standards are technically feasible and commercially viable. They believe that the complexity and projected impact of the Tier 4 rule warrants a detailed assessment of the rate of progress towards implementation of the necessary advanced technologies.

Lister Petter also commented that we should consider whether the appropriate aftertreatment systems and fuel injection systems for smaller engines are available from more than one source to avoid any type of supply monopoly situation to protect customers and users from excessive costs.

AED added that the technology review should re-examine the impact that the new regulations will have on the unit and operating costs of equipment and should reassess the costs associated with delivering the new technology to equipment users. They believe that if the cost increases are too high, equipment users will be less likely to invest in new engines with clean diesel technologies. (See additional discussion under Issue 5.1).

Kubota commented that the standards will not succeed if engine and equipment manufacturers cannot recover the significant investment in product development. They believe that we should fully examine the economic impact of the proposed rule including other factors in the rulemaking that either directly or indirectly impact economics, including the feasibility of the transient test for small engines and the feasibility of the NO_x phase-in for engines in the 56 to 230 kW power category.

The American Trucking Association (ATA) also commented that it is critical that we commit to on-going reviews of the nonroad rule regarding the state of engine technology developments and the state of fuel availability, purity, and costs to ensure that sufficient progress is being made. They believe that the reviews that we have conducted for the on-road rule have proven to be very useful. ATA asserted that we should remain flexible when evaluating the progress and should consider revising the proposed standards, as appropriate, to accommodate the wide power range of nonroad engines.

Letters:
American Road and Transportation Builders Association, OAR-2003-0012-0633 p. 2
American Trucking Association, OAR-2003-0012-0632 p. 4-5
Associated Equipment Distributors, OAR-2003-0012-0831 p. 2-3
Associated General Contractors of America, OAR-2003-0012-0791 p. 5-6, 11
Association of Equipment Manufacturers, OAR-2003-0012-0669, 0670 p. 4-5
CEMA-CECE, OAR-2003-0012-0598 p. 3, 5
CNH Global, OAR-2003-0012-0819 p. 10
Ingersoll-Rand, OAR-2003-0012-0504 p. 13
Kubota, OAR-2003-0012-0620 p. 1-2
Lister Petter, OAR-2003-0012-0155 p. 2

Our Response:

As discussed in the proposal, we do not believe that a generalized technology review of the sort being conducted for the heavy-duty highway engine program is warranted, primarily due to the very fact that the nonroad standards are modeled on the highway program, and the highway program does include this comprehensive review. We also do not see the specific technical issues for engines above 75 hp that have been identified for smaller engines, such as might warrant our expanding the review at this time. We have not determined at this time what specific actions should be taken to prepare for and conduct the 2007 technology review, and so we do not feel it appropriate to evaluate or provide our opinions on the usefulness of future actions suggested by commenters, such as a government/industry pilot program or demonstration projects.

In response to the comments we received, we wish to clarify that the technology review for engines under 75 hp will be a comprehensive undertaking that may result in adjustments to standards, implementation dates, or other provisions (such as flexibilities) in either direction (that is, toward more or less stringency), depending on conclusions reached in the review about appropriate standards under the Clean Air Act. All relevant factors including technical feasibility and commercial viability of engines and machines designed to meet the standards will be taken into account.

3.9.3 The Proposed Technology Review Is Unnecessary

What Commenters Said:

NRDC and STAPPA/ALAPCO commented that we should not undertake a mid-term technology review at the outset of the implementation period. They believe that this review could be used to delay final decision-making and undermine the regulatory certainty that is necessary for industry to commit the resources to develop new technologies, build new infrastructure, or make other investments. However, they stated, in some cases a limited mid-term technology review that is clearly defined in terms of scope, duration and range of outcomes may be beneficial (such as for engines less than 75 hp). The commenters also believe that if we choose to conduct a technology review, the possibility of tightening the standards beyond those adopted as part of this rulemaking should be included if technology has advanced sufficiently to make tighter standards feasible.

Letters:
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 20-21, 33
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 17-18

Our Response:

As is described in Section VIII.A of the preamble to this final rule, we believe that the technology review that we are planning is necessary and appropriate, considering issues that we have identified for the application of advanced aftertreatment on engines under 75 hp. At this time we have not decided what long-term PM standards for engines under 25 hp are appropriate. No PM filter-based standards are being adopted for these under 25 hp engines in this final rule. Likewise, we have not decided what the long-term NOx standards for engines under 75 hp should be, and no NOx adsorber-based standards are being set for these engines in this final rule. As part of the technology review, we plan to thoroughly evaluate progress made toward applying advanced PM and NOx control technologies to these smaller engines. We considered carefully the scope of this review and believe it appropriate.

3.9.4 Timing

What Commenters Said:

NY DEC commented that (if possible) our proposed technology review for 2007 for the under 25 horsepower category and the 25 to 75 hp category should be conducted in 2005.

Environmental Defense and WRAP commented that we should make a binding commitment in the final regulations to complete a technology review and adopt appropriate additional standards for engines under 75 hp no later than 2006. They believe that this deadline is pivotal for states facing multi-faceted SIP submittal deadlines in 2007 for the 8-hour ozone standard, PM2.5 standard and regional haze protections.

Yanmar commented that little or no information from the field will be available in 2007, particularly on the reliability and durability of NO_x aftertreatment systems, given that this coincides with the implementation of the highway rule. They believe that it will take a longer period of time to evaluate the on-highway field experiences and apply the appropriate technologies to small CI engines. Yanmar suggested that we should conduct a technology review no earlier than 2010, since it would allow 3 years after the implementation of the 2007 highway regulations to evaluate the effectiveness of technologies and the potential for their application in smaller engines.

Letters:
Yanmar, OAR-2003-0012-0615, 0813 p. 7
Environmental Defense, OAR-2003-0012-0821 p. 8-9
Western Regional Air Partnership, OAR-2003-0012-0774, 0775 p. 2
New York Public Hearing, A-2001-28, IV-D-05 [NY DEC p. 14]

Our Response:

We disagree with Yanmar's view that the technology review should be delayed because little or no information from the field will be available in 2007. Based on the rate of technology development progress to date for highway engines, we believe that there will be a very large amount of pertinent new information available by 2007, even though widespread field experience may be lacking. Waiting longer to conduct the technology review would, we believe, provide insufficient leadtime to the industry should an adjustment to the 2013 standards be found appropriate. On the other hand, we also do not believe that the review should be moved up to 2005 or to a date that would allow for a rulemaking setting revised or additional standards to be completed by 2006, as we do not expect fundamentally new information to become available this early. We continue to believe that 2007 is the appropriate time to conduct the review.

3.10 Other Standards and Technology Issues

3.10.1 Retrofit Program

What Commenters Said:

Several commenters stated that we should implement programs that would encourage emission reductions from existing nonroad engines. CATF, SCAQMD, and SACE all commented that existing engines will comprise a majority of the nonroad fleet for years to come, and therefore we should develop requirements for these engines, which could be in the form of retrofit regulations, sales requirements or incentive programs. The commenters stated that given the long useful life of diesel engines and the lengthy period before diesels complying with the new standards will replace significant numbers of the existing fleet, we should support substantial funding to enable the retrofit of existing diesel engines and should consider making full use of enforcement penalties to achieve as many retrofits as possible.

Environmental Defense also commented that we should create incentives for diesel retrofits. They believe that these could provide more immediate public health and welfare gains without all of the complex issues associated with providing formal emission reduction credits for such action. They added that cost-effective retrofit programs like the Carl Moyer program in California are necessary to make significant progress in the near term.

We also received several comments (from AGCA, BCTD, IBT, IUOE, LHSFNA) which stated that we should not impose a requirement to retrofit existing nonroad engines, but should consider developing voluntary diesel retrofit programs. They believe that such programs should incorporate research and development of engineering controls in order to minimize the economic burden on employers seeking efficient methods of reducing diesel emissions from existing equipment.

The Idaho Wheat Commission and the National Association of Wheat Growers, et al commented that farmers are already stretched to the limit financially and many can barely afford the machines and equipment necessary to run their farm. They believe that we should not burden farmers with regulations that would force the retrofit of their existing nonroad engines, particularly since the cost of retrofitting these older engines is often greater than the value of the machine itself.

EMA expressed support for a retrofit program that would provide ABT program credits for retrofitted engines. However, EMA argued that it is premature to do so as part of this rule, and instead stated interest in working with EPA to develop a sound program.

Letters:
Associated General Contractors of America, OAR-2003-0012-0791 p. 14
Building and Construction Trades Dept., AFL-CIO, OAR-2003-0012-0674 - 0676 p. 1
Clean Air Task Force, et. al., OAR-2003-0012-0508 p. 20
Environmental Defense, OAR-2003-0012-0821 p. 18
Idaho Wheat Commission, et. al., OAR-2003-0012-0645 p. 1
International Brotherhood of Teamsters, OAR-2003-0012-0664 p. 2
International Union of Operating Engineers, OAR-2003-0012-0600 p. 3
Laborer's Health and Safety Fund of North America, OAR-2003-0012-0638 p. 2
National Association of Wheat Growers, et. al., OAR-2003-0012-0752 p. 2
South Coast Air Quality Management District, OAR-2003-0012-0623 p. 3, 5-6
Chicago Public Hearing, A-2001-28, IV-D-06 [SACE p. 185]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [1 public citizen p. 119]
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 39

Our Response:

We agree that programs to encourage the retrofitting of existing nonroad engines with clean technologies are worth considering, and we asked for comment on one idea for such a program in the proposal. Considering the issues raised in comments we received, we are not ready to finalize such a program in this rule. We will continue to investigate whether such a program can be developed to achieve emission reductions sooner than would otherwise be possible with programs focused on new engines.

3.10.2 Retirement of Older Engines

What Commenters Said:

SCAQMD and NY DEC both commented that we should design the standards in a manner that would encourage the retirement of existing sources, they believe that this approach would help accelerate reductions from the nonroad sector. NY DEC specifically recommended that we create incentive programs that will increase fleet and engine turnover in nonroad applications in order to accelerate emissions reductions in the field.

Letters:
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 8
Los Angeles Public Hearing, A-2001-28, IV-D-07 [SCAQMD p. 119]

Our Response:

We agree that provisions to encourage the early retirement of older engines would accelerate reductions from the nonroad sector. However, such provisions would be outside the scope of this rulemaking, and we did not propose or request comment on any such provisions.

3.10.3 Effect on Existing Engines

What Commenters Said:

Several commenters stated that we should clarify how this rule might affect existing nonroad engines.

FWEDA, NAEDA, OMEDA, and USA Rice Federation all commented that we should evaluate and provide addition information on how the 15 ppm sulfur standard will affect the operation of these engines, whether a retrofitting requirement will be included, and whether there will be any restrictions on the sale of used equipment in general. They believe that we should consult with the equipment dealer industry to evaluate issues related to how the rule will affect the used equipment market in general.

AGCA, CHS, NMA, and WBRT all believe that given the fact that the production of higher sulfur diesel will be significantly reduced or eliminated following the implementation of this rule, existing engines will be forced to use low or ultra-low sulfur diesel. However, they stated, no assessment has been completed on the impact of low sulfur (<500 ppm) or ultra low sulfur (<15 ppm) diesel on engine efficiencies. Further, the commenters believe that low sulfur fuels may have an adverse impact on engine efficiencies, engine life, and maintenance. WBRT provided additional discussion on this issue noting that the highway rule will not provide sufficient information in this regard given that the types of use, demands, and sizes of the nonroad engines are generally much broader and thus, can differ significantly as compared to highway engines. The commenters recommended that we fully investigate the potential impact of low sulfur diesel on existing engines.

AGCA also commented that the use of ultra-low sulfur diesel may cause certain types of fuel system seals to leak. They added that this issue has been addressed in most engines after 1993, but owners and operators of pre-1994 equipment may not be able to use ultra-low sulfur diesel since it would not be compatible with certain engine components. AGCA believes that this may pose a problem for the construction industry if the low sulfur fuel enters the market too quickly, and therefore we should consider this possibility as the nonroad rule is finalized.

<u>Letters:</u>
Associated General Contractors of America, OAR-2003-0012-0791 p. 14
CHS Inc., OAR-2003-0012-0785 p. 3
Far West Equipment Dealers Association, OAR-2003-0012-0679 p. 4-5
National Mining Association, OAR-2003-0012-0510 p. 2
North American Equipment Dealers Association, OAR-2003-0012-0647 p. 4-5
Ohio-Michigan Equipment Dealers Association, OAR-2003-0012-0747 p. 4-5
USA Rice Federation, OAR-2003-0012-0652 p. 4-5
Western Business Roundtable, OAR-2003-0012-0636 p. 2-3

Our Response:

The final rule contains no requirements for retrofitting existing engines or equipment. It also does not contain any restrictions on the sale of used equipment. Both beneficial and adverse potential impacts of lower sulfur fuel on existing engines have ben evaluated in the rulemaking. See Sections IV.G of the preamble to this final rule and Chapter 6 of the RIA. A sizeable base of information on these impacts has already accumulated in the highway sector as fuel with 500 ppm maximum sulfur has been required there since 1993, and is also required in the nonroad sector in California, and experience with 15 ppm sulfur fuel is now beginning to occur. Based on the comments we have received, manufacturers appear to be confident that lessons learned from the highway experience will ensure a smooth transition to lower sulfur fuels for existing nonroad engines.

3.10.4 EPA Should Require Reductions from All Combustion Sources

What Commenters Said:

NY DEC commented that we should examine other sources of fine particulate matter and ozone precursors, including aircraft and ocean-going marine vessels, in addition to this rule. They added that although these are not emission standards in the traditional sense, programs to facilitate the electrification of those applications where connection to the electric grid is feasible, such as around airports and truck refrigeration units at loading docks, could provide significant emissions reductions, particularly in high-impact local areas.

The New York Office of Environmental Coordination and New York Waterways believe that we should encourage the expansion of retrofit technologies for marine engines. They commented that some companies are currently upgrading their ferries' engines. NY Waterways noted that they will have upgraded all of their engines to state of the art IMO compliance electrically controlled engines by January 2005, they believe a regulatory push by EPA could encourage these and other retrofits and upgrades.

WESTAR commented that commercial marine vessels contribute significant quantities of emissions in several major port cities, and further, marine vessel emissions exceed or are likely to exceed the emissions from other mobile source categories in some locations. WESTAR believes that we should align commercial marine vessel diesel fuel sulfur and exhaust aftertreatment standards to levels equivalent to those for other nonroad and highway mobile source categories.

CARB commented that since there are a significant number of recreational diesel-powered watercraft, they believe that we should promulgate a PM standard for these engines based on the reduction capacity of oxidation catalysts in the near term, followed by Tier 4 equivalent levels in the 2013 time frame. They noted that the precedent for these standards has already been established in California with CARB's adoption of catalyst-forcing standards for 2009 gasoline-fueled boats. CARB further stated that the technology needed to adopt diesel aftertreatment testing to a water-based environment would be almost identical to that for gasoline water-based engines; and recent testing has verified the safety of onboard catalysts for these engines.

Yanmar supports regulating marine diesel engines below 37 kW in a future rulemaking. They noted that they are willing to work with us to develop practical and effective regulations for these smaller engines.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 5
New York City Office of Environmental Coordination, OAR-2003-0012-0631 p. 2
Western States Air Resources Council, OAR-2003-0012-0711 p. 2-3
Yanmar, OAR-2003-0012-0615, 0813 p. 9
New York Public Hearing

A-2001-28, IV-D-05 [CARB p. 144; NY DEC p. 15; NY Waterways p. 190]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [CARB p. 16, 70]

Our Response:

Emissions standards for marine engines, locomotives, and aircraft involve issues not examined in this rulemaking. We recognize the importance of controlling emissions from these sources and are pursuing control of these emissions in separate actions.

3.10.5 Reactive Oxygenated Species

What Commenters Said:

EMA supports the proposal of not including separate standards for reactive oxygenated species. They state that given the current level of understanding of potential emissions control technologies, our approach of accounting for the reactive oxygenated species as a fraction of the THC seems reasonable.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 71

Our Response:

We agree that separate EPA standards for reactive oxygenated species would not be appropriate at this time.

3.10.6 Rental Engines

What Commenters Said:

ARA commented that the standards could be difficult to maintain for rental engines, since they are subject to multiple users, thus leading to a higher potential for misfueling. They believe that the proposed rule creates a problem for rental owners who will be liable for the performance of emissions control systems but will not be able to control the fuel introduced into those systems by renters. They noted that the emissions control systems are highly sensitive to sulfur and the use of high sulfur fuel, whether deliberate or unintentional, will void the emissions warranty. And repeated misfueling would cause systems to fail and in the event that in-use testing becomes a reality, ARA members would become responsible for the repair costs caused by equipment renters. ARA stated that given the fact that higher sulfur fuels will be available in the market even after Tier 4 engines are introduced and the possibility for contamination of low sulfur fuels from higher sulfur kerosene or lube oils, we should implement enforcement procedures that discourage misfueling (including any OBD that could help detect and prevent misfueling) and should work with states to help minimize the use of heating oil and lube oil in nonroad fuels.

Letters:
American Rental Association, OAR-2003-0012-0612 p. 5

Our Response:

We have adopted provisions to discourage misfueling, such as by requiring warning labels on fuel pumps and on equipment at the fuel filler inlet, and by making it illegal for anyone to pump higher sulfur fuel into nonroad equipment after certain dates. The highway diesel rule adopted similar provisions. Beyond these, as discussed in Section VIII of the preamble to the nonroad diesel proposal, we have had subsequent discussions with fuel retailers, wholesale purchaser-consumers, vehicle manufacturers, and nozzle manufacturers and continue to examine additional methods for preventing accidental or intentional misfueling under the highway diesel fuel sulfur program. Although no consensus yet exists among the affected stakeholders, we will continue discussions with these and other stakeholders, and we will consider any new developments that result from these highway discussions in any future nonroad action. For example, it may be sensible to create an educational program as the Tier 4 program approaches to help ensure that users are made aware of the serious consequences of misfueling. We would expect too that rental companies may want to avoid unnecessary and potentially expensive repairs by including agreements about proper fueling in rental contracts and by posting information to potential renters.

3.10.7 EPA Should Use the International SI-units

What Commenters Said:

CEMA-CECE and Euromot commented that we used a different set of units in the preamble (e.g. hp) and in the regulation (e.g. kW), which they believe is confusing. They suggested that we should refrain from using Imperial units, as it causes unnecessary work and may lead to mistakes.

Letters:
CEMA-CECE, OAR-2003-0012-0598 p. 5
Euromot, OAR-2003-0012-0822, 0823 p. 11

Our Response:

Consistent with past EPA rulemakings for nonroad diesel engines, our regulations express standards, power ratings, and other quantities in international SI (metric) units--kilowatts, gram per kilowatt-hour, etc. This aids in achieving harmonization with standards-setting bodies outside the U.S., and in laboratory operations in which these units are the norm. However, in the preamble and in other rulemaking documents for the general reader, we have chosen to use terms more common in general usage in the U.S. Hence standards are expressed in units of grams per brake horsepower-hour, power ratings in horsepower, etc. In any compliance questions that might arise from differences in these due to, for example, rounding conventions, the regulations themselves establish the applicable requirements.

4. NONROAD DIESEL FUEL STANDARDS

What We Proposed:

The comments in this section correspond to Sections IV and VIII of the NPRM, and therefore are targeted at fuel related issues from the proposal. A summary of the comments received, as well as our response to those comments are located below.

4.1 Level of Diesel Fuel Sulfur Standard (both initial 500 ppm and subsequent 15 ppm standards)

4.1.1 General Support for 15 ppm Fuel Sulfur Standard

What Commenters Said:

We received many comments supporting implementation of a 15 ppm fuel sulfur standard. These commenters all noted that the 15 ppm standard should be implemented as soon as possible to facilitate the development and implementation of advanced emission controls. Without such low sulfur fuel, the technologies capable of achieving tight emissions standards will be rendered inoperable. EMA specifically noted that diesel fuel with sulfur levels near zero, and no higher than 15 ppm, is necessary for the implementation of the Tier 4 standards since the level of emission reductions required under the proposed Tier 4 rule will drive the use of NO_x aftertreatment, catalyzed particulate filters, and other advanced aftertreatment technologies that require low sulfur fuel. In addition, Caterpillar commented that given the prosperous state of the oil industry, financial constraints should not be an issue in ensuring compliance with a 15 ppm standard within the proposed time frame. *[See Issue 4.2.2 for a discussion of the 15 ppm compliance deadlines as supported by these commenters.]*

<u>Letters:</u>
CNH Global, OAR-2003-0012-0819 p. 3
California Air Resources Board, OAR-2003-0012-0644 p. 6
Caterpillar, Inc., OAR-2003-0012-0812 p. 1
City of Houston - Office of the Mayor, OAR-2003-0012-0630 p. 2
Clean Air Council, OAR-2003-0012-0613 p. 2
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 6
Environmental Advocates of NY, OAR-2003-0012-0523 p. 1-2
Environmental Defense, OAR-2003-0012-0821 p. 7, 14-15
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 9-10
NESCAUM, OAR-2003-0012-0659 p. 6
New York City Office of Environmental Coordination, OAR-2003-0012-0631 p. 2
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 2
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 9
Salt Lake City, OAR-2003-0012-0787 p. 1
South Coast Air Quality Management District, OAR-2003-0012-0623 p. 3, 6
U.S. Public Interest Research Group, OAR-2003-0012-0780 p. 2
Wisconsin Department of Natural Resources, OAR-2003-0012-0702, 0703 p. 3

73,742 Public Citizens
1,086 Public Citizens
New York Public Hearing
A-2001-28, IV-D-05 [1 public citizen; CARB p. 141; Caterpillar p. 76; ED p. 151; NESCAUM p. 98; OTC p. 210; STAPPA/ALAPCO p. 46; U.S. PIRG p. 188]
Los Angeles Public Hearing
A-2001-28, IV-D-07 [ALA p. 111, 174, 220; CARB p. 13; Caterpillar p. 82; CAT p. 184; EMA p. 151; MECA p. 60; STAPPA/ALAPCO p. 27; U.S. PIRG p. 178]
Chicago Public Hearing
A-2001-28, IV-D-06 [AEM p. 219; CNH p. 66; Caterpillar p. 59; CAT p. 156-158; MECA p. 48; STAPPA/ALAPCO p. 38; U.S. PIRG p. 12]

The Alliance commented that the main advantage of capping sulfur in nonroad diesel fuel at 15 ppm is that it is identical to the recently finalized highway diesel standard, and as such will maintain the fuel's fungibility. However, EPA's selection of this limit was predicated on the expectation that refiners will produce fuel at levels far below this cap. This compliance margin may not persist over time, depending on sulfur measurement technology and contamination rates in the distribution system. As these methods become more precise, reliable and convenient for field applications, the amount of fuel degradation will decrease and the compliance margin will shrink as a result. In addition, as fuel distributors gain experience handling ultra-low sulfur diesel, they will further reduce fuel degradation. The Alliance expressed support for our proposal to reduce the sulfur in NRLM to 15 ppm but adds that a near-zero sulfur level would be preferable. The commenter recommended that given the potential for a smaller compliance margin and the fact that compliant engines will operate best on near-zero sulfur levels, EPA should cap the sulfur level below 10 ppm.

Letters:
Alliance of Automobile Manufacturers, OAR-2003-0012-0792 p. 1-2

CARB and Countrymark both commented that national alignment of the fuel sulfur standard by 2010 will ensure that all equipment operating in California will use clean fuel, regardless of its origin. CARB also noted that it plans to adopt a 15 ppm sulfur standard for on-road and nonroad diesel fuel purchased in California, effective in 2006.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 6
Los Angeles Public Hearing, A-2001-28, IV-D-07 [CARB p. 14; Countrymark p. 142]

Our Response:

We agree with comments supporting our decision to finalize a 15 ppm sulfur limit in today’s rule. We recognize the concerns expressed that we should consider setting the cap even lower. However, we are confident that the program that we are finalizing today- 15 ppm sulfur fuel- will be sufficient for Tier 4 compliant engines to operate on, that refiners will be able to meet this cap with a certain degree of compliance margin, and that all parties in the fuel distribution system will be able to maintain the fuel at a sulfur level below this standard.

4.1.2 Incentives for Early Compliance

What Commenters Said:

We received two comments which stated that we should offer incentives for early compliance. The South Carolina Department of Health and Environmental Control commented that these incentives would be particularly beneficial to areas promoting and implementing diesel retrofits for school buses and off-road equipment and would further encourage the retrofits to be used. Similarly, the Clean Air Task Force commented that we should explore various mechanisms to provide incentives for the early introduction of ultra-low sulfur diesel into major metropolitan areas.

Letters:
New York Public Hearing, A-2001-28, IV-D-05 [CATF p. 235]
South Carolina Department of Health & Environmental Control, OAR-2003-0012-0476 p. 2

Our Response:

Refiners and importers may in fact generate early credits for the production of 500 ppm sulfur NRLM diesel fuel from June 1, 2006 through May 31, 2007 and for the production of 15 ppm sulfur NRLM diesel fuel from June 1, 2009 through May 31, 2010. Though the credit generation provisions are not specifically geared towards major metropolitan areas, as suggested in the comments, we believe that they can help facilitate some of the environmental benefits of the program being achieved earlier than otherwise required, and may increase the overall environmental benefits of the program. Credits for the early production of 500 and/or 15 ppm sulfur fuel are fungible, may be banked for future use, or traded to another refiner or importer. Further, provisions are included in the final rule to ensure that these early credits are real and not merely shifts from the highway market.

4.1.3 Home Heating Oil

What Commenters Said:

West Harlem Environmental Action, Sinclair, and the Ozone Transport Commission commented that home heating oil should also be subject to a low sulfur standard. Sinclair added that there is currently no national sulfur standard for home heating oil, and state sulfur regulations for residential, commercial and industrial distillate fuel oil range from 2,000 to 4,000 ppm. Sinclair further noted that if it is assumed that current sulfur levels for these fuels are 2,000 ppm on average, a reduction to 15 ppm sulfur level would eliminate nearly 200,000 tons per year of SO_2 emissions nationwide.

Letters:
Sinclair Oil Corporation, OAR-2003-0012-0704, 0829 p. 2
New York Public Hearing, A-2001-28, IV-D-05 [OTC p. 214; W. Harlem EA p. 261]

WRAP and Chevron commented that some of the expected benefits of the proposed sulfur controls may be eroded by increases in sulfate emissions resulting from refiners selectively diverting more difficult to desulfurize distillate streams into home heating fuels. They commented that we are missing a significant opportunity to capture additional sulfate reduction benefits that would further improve visibility in Class I areas in the northwest and northeast states. The commenters further stated that we should take steps to control the sulfur content of heating fuels to 500 ppm as well. Even though the CAA does not provide EPA with the authority to directly regulate heating fuel sulfur content, it is within EPA's capability to facilitate a coordinated action among the affected states, which do have the authority to regulate heating fuel sulfur content. WRAP also noted that this approach could result in a reduction of over 1,000 tons per year in additional sulfate reductions for the WRAP states and well over 100,000 tons per year nationally. Lastly, Chevron suggested that states could cap heating fuel sulfur at 500 ppm simultaneously with the implementation of the first step to a 500 ppm cap for nonroad fuels. In addition to the considerable sulfate reduction benefits such a requirement would provide, a 500 ppm sulfur cap on heating fuel would eliminate the need for a new marker or dye for heating fuel, at least until mid-2010.

Letters:
Western Regional Air Partnership, OAR-2003-0012-0774, 0775 p. 2
Chevron, OAR-2003-0012-0782 p. 2

Environmental Defense commented that EPA may have ample legal authority to address the sulfur content of home heating oil and should provide technical and policy resources to help states adopt low sulfur fuel program for home heating oil.

Letters:
Environmental Defense, OAR-2003-0012-0821 p. 16

CNH Global commented that EPA should require the 500 ppm sulfur fuel be distributed to markets other than the nonroad industry such as home heating fuel, etc. or alternatively, release the engine manufacturer from legal liability from misfueling.

Letters:
CNH Global, OAR-2003-0012-0819 p. 2

Our Response:

Title 2 of the CAA provides authority for fuels used in motor vehicles and nonroad equipment. This authority, does not extend to regulating the content of fuels used in stationary sources. Title 1 provides EPA with authority to control emissions from certain stationary sources, but contains no direct authority to set standards for fuel used in stationary sources.

Though we are not regulating heating oil, we do expect that the sulfur levels of heating oil will decrease because of this rulemaking. Beginning in mid-2007, we expect that controlling NRLM diesel fuel to 500 ppm sulfur will lead many pipelines to discontinue carrying high sulfur heating oil as a separate grade. In areas served by these pipelines, heating oil users will likely switch to 500 ppm sulfur diesel fuel and ultimately 15 ppm diesel fuel. This will reduce emissions of sulfur dioxide and sulfate PM from furnaces and boilers fueled with heating oil. The primary exception to this will likely be the Northeast, where a distinct higher sulfur heating oil will still be distributed as a separate fuel. Also, we expect that a small volume of moderate sulfur distillate fuel will be created during distribution from the mixing of low sulfur diesel fuels and higher sulfur fuels, such as jet fuel, in the pipeline interface. Such moderate sulfur distillate will likely be sold by the terminal as high sulfur heating oil, but in fact its sulfur level will be much lower than that normally sold as heating oil. It may also be sold as locomotive and marine fuel outside the Northeast/Mid-Atlantic Area, if it is less than 500 ppm. Alternatively, this material could be reprocessed by transmix processors.

4.2 Timing

4.2.1 500 ppm Fuel Sulfur Standard

What Commenters Said:

We received numerous comments stating that the proposed 2007 compliance deadline for the 500 ppm standard is feasible and appropriate. These commenters noted that meeting the 500 ppm diesel fuel standard by mid-2007 will be a challenge, but remains a realistic compliance deadline. They further commented that any modifications to the nonroad proposal that would accelerate the implementation schedule of a 500 ppm standard could reduce the overall volume of the diesel fuel pool. The commenters stated that refiners are in the process of engineering appropriate refinery modification to meet the 15 ppm highway standard in June 2006, and the refining industry is already within the 4-year time period typically required to make such modifications; any acceleration of the process would result in additional negative supply consequences. *[See additional discussion under Issues 4.3]*

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 1
American Road and Transportation Builders Association, OAR-2003-0012-0633 p. 3
Associated General Contractors of America, OAR-2003-0012-0791 p. 12-13
Association of Equipment Manufacturers, OAR-2003-0012-0669, 0670 p. 15
BP, OAR-2003-0012-0649 p. 1
Chevron, OAR-2003-0012-0782 p. 1
Citgo Petroleum Corporation, OAR-2003-0012-0707 p. 1
ConocoPhillips, OAR-2003-0012-0777 p. 2
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 4
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 5-6
Environmental Advocates of NY, OAR-2003-0012-0523 p. 2
Ergon, Inc., OAR-2003-0012-0634 p. 2
ExxonMobil, OAR-2003-0012-0616 p. 2, 9
Flint Hills Resources, OAR-2003-0012-0667 p. 4
International Brotherhood of Teamsters, OAR-2003-0012-0664 p. 2
International Union of Operating Engineers, OAR-2003-0012-0600 p. 2
Kubota, OAR-2003-0012-0620 p. 1
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 11
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 1
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 2-4, 14-15
NESCAUM, OAR-2003-0012-0659 p. 6-7
New England Fuel Institute, OAR-2003-0012-0712, 0713 p. 1
Tesoro, OAR-2003-0012-0662 p. 1
New York Public Hearing

A-2001-28, IV-D-05 [API p. 19; AOPL p. 173; EMA p. 102; MECA p. 119; NPRA p. 82]
Los Angeles Public Hearing
A-2001-28, IV-D-07 [API p. 40; Cummins p. 33; EMA p. 151; MECA p. 61]
Chicago Public Hearing
A-2001-28, IV-D-06 [API p. 83; BP p. 170; EMA p. 26; Ergon p. 239; NACS/SIGMA p. 244; NPRA p. 16]

EMA commented that the compliance deadline for the 500 ppm standard should be accelerated. EMA believes that the 500 ppm nonroad diesel fuel sulfur standard should be in place by January 1, 2007. EMA further commented that, in order to support the advanced technologies that are required for existing Tier 3 standards and new Tier 4 standards, EPA must require implementation of low sulfur fuel by this date or as soon as possible. If the January deadline cannot be met, in no event should this cap be implemented any later than June 2007. Typically heavy-duty engine manufacturers introduce new engine models in the previous calendar year. The 2008 model year could begin as early as January 2, 2007. With such an early start of production date, emission systems could be in jeopardy without the required fuel.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 8, 110

Environmental Defense, WRAP, and WESTAR commented that the 500 ppm sulfur standard should apply in June 2006, rather than June 2007, since this will harmonize the nonroad and highway rules and will eliminate the presence of a third grade of diesel fuel (5,000 ppm nonroad/locomotive) in the supply and distribution network throughout most of the country for this one year. Environmental Defense specifically recommended that if the one-step approach is not taken, an accelerated two-step approach requiring 500 ppm fuel in June 2006 should be followed; and, that there is strong support among a variety of western interests for this approach. *[See additional discussion under Issues 4.2.1]*

Letters:
Environmental Defense, OAR-2003-0012-0821 p. 15
Western Regional Air Partnership, OAR-2003-0012-0774, 0775 p. 1
Western States Air Resources Council, OAR-2003-0012-0711 p. 1

Our Response:

We believe that the time frame being finalized today is both necessary and sufficient for refiners and others throughout the distribution system to plan for and implement desulfurization technologies. As this first step is only to 500 ppm sulfur, we have allowed for a short lead time for implementation, this will enable the environmental benefits to begin accruing as soon as possible, and this time frame is consistent with the current specification for highway diesel fuel. This rule will provide refiners and importers approximately 38 months before they will have to begin complying with the 500 ppm cap for NRLM diesel fuel on June 1, 2007. Our lead time analysis projects that 27-39 months are typically needed to design and construct a diesel fuel hydrotreater.[16] Thus, we believe that the lead time available

[16]The leadtime analysis in the RIA can be found in Section 5.3.

for the 500 ppm cap in mid-2007 will be sufficient. At the same time, however, attempting to implement the standard any sooner would not provide sufficient lead time for a number of refineries. These parties will need the time to secure financing, begin plans for desulfurization technique, and to optimize their processes (to ensure production of 500 ppm sulfur NRLM fuel) once they have stepped down to the 500 ppm level. EPA does not expect that the Tier 3 engines will be jeopardized by this date, as the Tier 3 emissions standards are not premised on such low sulfur diesel fuel.

4.2.2 15 ppm Fuel Sulfur Standard

What Commenters Said:

We received many comments which stated that the proposed 2010 compliance deadline for the 15 ppm standard is feasible and appropriate, and that meeting the 15 ppm diesel fuel standard by mid-2010 will be a challenge, but remains a realistic compliance deadline. EMA noted that in order to support the advanced technologies that are required for EPA's Tier 4 proposal, it is essential that EPA require implementation of lower sulfur fuel at least by the date proposed or as soon as possible and recommends a January 1, 2010 deadline; and further, that if this cannot be met, the 15 ppm standard be in place no later than June 2010. *[See additional discussion under Issue 4.3]*

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 1
American Road and Transportation Builders Association, OAR-2003-0012-0633 p. 3
Associated General Contractors of America, OAR-2003-0012-0791 p. 12-13
Association of Equipment Manufacturers, OAR-2003-0012-0669, 0670 p. 15
BP, OAR-2003-0012-0649 p. 1
Chevron, OAR-2003-0012-0782 p. 1
Citgo Petroleum Corporation, OAR-2003-0012-0707 p. 1
ConocoPhillips, OAR-2003-0012-0777 p. 2
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 4
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 5-6, 8, 110
Environmental Advocates of NY, OAR-2003-0012-0523 p. 2
Ergon, Inc., OAR-2003-0012-0634 p. 2
ExxonMobil, OAR-2003-0012-0616 p. 2, 9
Flint Hills Resources, OAR-2003-0012-0667 p. 4
International Brotherhood of Teamsters, OAR-2003-0012-0664 p. 2
International Union of Operating Engineers, OAR-2003-0012-0600 p. 2
Kubota, OAR-2003-0012-0620 p. 1
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 11
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 1
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 2-4, 14-15
NESCAUM, OAR-2003-0012-0659 p. 6-7
New England Fuel Institute, OAR-2003-0012-0712, 0713 p. 1
Tesoro, OAR-2003-0012-0662 p. 1
New York Public Hearing
A-2001-28, IV-D-05 [API p. 19; AOPL p. 173; EMA p. 102; MECA p. 119; NPRA p. 82]

Los Angeles Public Hearing
A-2001-28, IV-D-07 [API p. 40; Cummins p. 33; EMA p. 151; MECA p. 61]
Chicago Public Hearing
A-2001-28, IV-D-06 [API p. 83; BP p. 170; EMA p. 26; Ergon p. 239; NACS/SIGMA p. 244; NPRA p. 16]

Many commenters stated that the implementation timeline for the 15 ppm standard should be accelerated to expedite air quality improvements, and that we should pursue an earlier and more aggressive implementation of the fuel standards. Some commenters (the Alliance, Environmental Defense, OTC, RAPCA, STAPPA/ALAPCO) suggested full implementation of the 15 ppm standard by 2008, while others (ALA, Clean Air Council, CAT, Houston, UCS) suggested that this standard be in place by 2007. Clean Air Task Force recommended a 2009 compliance date, and noted that this is similar to EPA's option 2b. Some commenters (NY, SCAQMD, TCEQ) recommended a compliance deadline of 2006 but one of these commenters (NY) also acknowledged that there are constraints on the refining industry that could impact the implementation timeline. Other commenters (CARB, Clean Air Council, PA Department of Environmental Protection, U.S. PIRG, West Harlem Environmental Action; public citizens) noted generally that the schedule should be accelerated but do not recommend a specific date. One of these commenters (CARB) also noted that California will have ultra-low sulfur fuel in 2006 for on-highway, nonroad and certain stationary diesel engines, and another (West Harlem Environmental Action) noted that since onroad vehicles will be using ultra-low sulfur fuels starting in 2006, the schedule for nonroad diesel should be accelerated.

<u>Letters:</u>
Alliance of Automobile Manufacturers, OAR-2003-0012-0792 p. 2
California Air Resources Board, OAR-2003-0012-0644 p. 4
City of Houston - Office of the Mayor, OAR-2003-0012-0630 p. 2-3
Clean Air Council, OAR-2003-0012-0613 p. 2
Clean Air Task Force, et. al., OAR-2003-0012-0508 p. 12
Environmental Defense, OAR-2003-0012-0821 p. 7, 14-15
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 22-23
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 2
Pennsylvania Department of Environmental Protection, OAR-2003-0012-0699 p. 3
Regional Air Pollution Control Agency, OAR-2003-0012-0683 p. 2
South Coast Air Quality Management District, OAR-2003-0012-0623 p. 3, 6
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 9-10
Texas Commission on Environmental Quality, OAR-2003-0012-0716, 0717 p. 1
U.S. Public Interest Research Group, OAR-2003-0012-0780 p. 2
Union of Concerned Scientists, OAR-2003-0012-0830 p. 2-4
Wisconsin Department of Natural Resources, OAR-2003-0012-0702, 0703 p. 3
12,976 Public Citizens
170 Public Citizens
New York Public Hearing
A-2001-28, IV-D-05 [CATF p. 237; ED p. 151; NRDC p. 35; NY DEC p. 14; OTC p. 210; STAPPA/ALAPCO p. 46; W. Harlem EA p. 260]
Los Angeles Public Hearing
A-2001-28, IV-D-07 [ALA p. 111, 174, 220; CAT p. 184; Countrymark p. 143; ED p. 93; SCAQMD p. 17; STAPPA/ALAPCO p. 28; U.S. PIRG p. 179; UCS p.

70]
Chicago Public Hearing
A-2001-28, IV-D-06 [ALA p. 284; CAT p. 157; STAPPA/ALAPCO p. 38]

USA Rice Federation and various dealer associations commented that we should clarify how 500 ppm fuel will be handled after the 2010 compliance deadline for 15 ppm fuel, since the proposed rule did not address how dealers and farmers should handle any 500 ppm fuel that is still in the tanks of trucks after the 2010 compliance deadline and whether EPA plans to purchase this fuel.

Letters:
Far West Equipment Dealers Association, OAR-2003-0012-0679 p. 5
North American Equipment Dealers Association, OAR-2003-0012-0647 p. 5
Ohio-Michigan Equipment Dealers Association, OAR-2003-0012-0747 p. 5
USA Rice Federation, OAR-2003-0012-0652 p. 5

Our Response:

Our primary driver for the timing of the 15 ppm NR standard is the timing of the engine standards, which will begin with the 2011 model year. We are confident that the June 1, 2010 start date for NR will provide the fuel necessary in time, particularly given the large volume of 15 ppm highway fuel produced beginning in 2006, as well as the early credit provisions that we are finalizing today. In addition, June 1, 2010 is consistent with the timing of the highway diesel program, and it will allow for a harmonized transition for both programs.

We also believe that there is a need for a period of lead time between the 500 ppm and 15 ppm standards. Given the challenge of meeting the 15 ppm standard, this step could not be required with the same timing as the first step to 500 ppm, and moving the 15 ppm step up earlier would obviate the ability to implement step 1. Furthermore, without step 1 we would lose important early benefits, since step 1 provides 90 percent of the fuel related benefits. This would result in a net loss of program benefits. Therefore, the timing that we are finalizing today for both steps of the program provides the optimal balance of lead time and environmental benefits. More discussion on this issue is located below in section 4.3.

4.3 Program Design

4.3.1 Two-Step Approach

4.3.1.1 Support for Two-Step Approach

What Commenters Said:

A number of commenters were in support of the proposed two-step approach for implementation of the fuel sulfur standards. The commenters stated that the two-step approach will provide additional flexibility over the alternative single-step approach that would impose a 15 ppm standard by 2008 and will provide additional benefits in the form of early and significant emission reductions. Commenters also stated that these early reductions will provide corresponding health benefits a year earlier than the more expensive, less flexible single-step approach. Some commenters (ConocoPhillips, Teamsters, IUOE, Tesoro) noted that this approach will also provide a more reasonable capital expenditure timeline and could reduce the economic burden to industry.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 1
Associated General Contractors of America, OAR-2003-0012-0791 p. 12-13
Chevron, OAR-2003-0012-0782 p. 1
ConocoPhillips, OAR-2003-0012-0777 p. 2
ExxonMobil, OAR-2003-0012-0616 p. 2, 9
International Brotherhood of Teamsters, OAR-2003-0012-0664 p. 2
International Union of Operating Engineers, OAR-2003-0012-0600 p. 2
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 1
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 2-4
Tesoro, OAR-2003-0012-0662 p. 1
New York Public Hearing
A-2001-28, IV-D-05 [API p. 19; NPRA p. 82]
Los Angeles Public Hearing
A-2001-28, IV-D-07 [API p. 40; Cummins p. 33]
Chicago Public Hearing
A-2001-28, IV-D-06 [API p. 83; NACS/SIGMA p. 244; NPRA p. 16]

Many commenters stated that adoption of the phased approach will help mitigate potential diesel fuel supply and distribution problems associated with the convergence of low sulfur highway and nonroad diesel. Refiners are preparing to reduce highway diesel to 15 ppm in 2006 and to meet a 15 ppm sulfur standard for nonroad diesel in one step by 2008 would be difficult and could exacerbate potential supply problems. By lowering the sulfur level to 500 ppm in mid-2007 as an interim measure followed by a 15 ppm standard in mid-2010 would provide refiners with a more adequate and feasible time frame for both planning and implementation of the standard. A two-step approach would also alleviate any potential adverse effects on fuel supply during the transitional period, by providing the industry with an outlet for higher sulfur distillates during refinery upsets and turnarounds. BP added that even small leakages from joints in feed product heat exchangers can necessitate the outlet for higher sulfur distillate products, and that with distillate feed stocks containing several thousand times as much sulfur as the new finished products, refineries will need to find ways to eliminate such small leakages and other sources of sulfur contamination. NPRA added that the two-step approach will help minimize the volume of diesel fuel that is lost due to contamination, loss of fungibility, or difficulties associated with desulfurization. AEM noted that a two-step method is more appropriate since it will help ensure an adequate supply to the nonroad market and maintain lower fuel costs. The commenters noted that if the fungible shipment of 500 ppm fuel is allowed, the two-step approach could provide a more reasonable approach since it would allow for fuel that is originally intended as 15 ppm nonroad diesel to be sold as 500 ppm nonroad diesel in the event that it is contaminated in the pipeline or that refineries experience difficulties associated with desulfurization. Commenters also stated that the potential for these circumstances will be greater during the initial implementation phase and as a result, the two-step approach, which provides a greater degree of flexibility, will help alleviate potential supply problems. API specifically referred to the Baker & O'Brien report as supporting documentation in the context of this issue.

Letters:

American Petroleum Institute, OAR-2003-0012-0804-0808 p. 1
American Road and Transportation Builders Association, OAR-2003-0012-0633 p. 3
Associated General Contractors of America, OAR-2003-0012-0791 p. 12-13
Association of Equipment Manufacturers, OAR-2003-0012-0669, 0670 p. 15
BP, OAR-2003-0012-0649 p. 1
Chevron, OAR-2003-0012-0782 p. 1
Citgo Petroleum Corporation, OAR-2003-0012-0707 p. 1
Environmental Advocates of NY, OAR-2003-0012-0523 p. 2
Ergon, Inc., OAR-2003-0012-0634 p. 2
Flint Hills Resources, OAR-2003-0012-0667 p. 4
Kubota, OAR-2003-0012-0620 p. 1
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 1
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 2-4
New England Fuel Institute, OAR-2003-0012-0712, 0713 p. 1
New York Public Hearing, A-2001-28, IV-D-05 [API p. 23; AOPL p. 173; NPRA p. 82]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [API p. 40; Cummins p. 33]
Chicago Public Hearing
A-2001-28, IV-D-06 [API p. 83; BP p. 170; Ergon p. 239; NPRA p. 17]

API and Marathon commented that refiners generally need four years to plan for and implement major changes in fuel specifications; refiners are already preparing to produce 15 ppm sulfur highway diesel starting in mid 2006 and it will be an additional challenge for refiners to significantly lower the sulfur level of nonroad fuel to 500 ppm by 2007. However, they stated, the two-step approach would provide the refining industry sufficient time and flexibility to transition smoothly to the 15 ppm sulfur level.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 1
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 1
New York Public Hearing, A-2001-28, IV-D-05 [API p. 20]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [API p. 40]
Chicago Public Hearing, A-2001-28, IV-D-06 [API p. 83]

DDC, EMA, and MECA commented that providing 500 ppm fuel in 2007 as part of the two-step approach, is important for providing fleet-wide emissions reductions and will help minimize excessive wear and increased maintenance costs. They noted that this is particularly true for engines that are equipped with exhaust gas recirculation (EGR) systems, which can be damaged without the use of low sulfur fuel. Lastly, the commenters stated, an interim 500 ppm standard will allow for the use of diesel oxidation catalysts (without which certain elements of EPA's proposed rule are not feasible), and will enable compliance with the Tier 3 standards.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 4
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 5-6
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 11
New York Public Hearing, A-2001-28, IV-D-05 [EMA p. 102; MECA p. 119]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [EMA p. 151; MECA p. 61]

Chicago Public Hearing, A-2001-28, IV-D-06 [EMA p. 26]

IFTOA commented that the two-step program will allow for the refining industry to reduce sulfur content gradually, thus minimizing the overall economic and compliance burden. However, IFTOA noted, for the northeast and other parts of the country that use home heating oil as a basic fuel, the burden of the rule will fall most heavily on terminals unable to store and distribute three streams of fuel (on-highway, nonroad and heating oil).

Letters:
Independent Fuel Terminal Operators Association, OAR-2003-0012-0671, 0672 p. 1

NESCAUM commented that we should finalize the schedule for introduction of low sulfur fuel as proposed, with no delays; as the introduction of ultra-low sulfur fuel in 2010 is crucial to the introduction of advanced emission control devices in new engines and is also essential for the expansion of state retrofit programs for nonroad engines. NESCAUM further stated that currently, the lack of readily available ultra-low sulfur diesel fuel is hampering state efforts to retrofit nonroad equipment.

Letters:
NESCAUM, OAR-2003-0012-0659 p. 6-7

NRDC, STAPPA/ALAPCO, UCS, and the Wisconsin Department of Natural Resources commented that they conditionally support EPA's two-step approach. It is preferable that EPA implement a one-step approach. Some commenters (NRDC, STAPPA/ALAPCO, UCS) noted that if a two-step approach is taken, EPA should use the baseline approach for implementing the sulfur phase-in. Others (UCS, WI) noted that if a two-step approach is taken, EPA should ensure that the 2007/2010 compliance schedule is maintained. *[See additional discussion under Issues 4.2.1]*

Letters:
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 22-23
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 9-10
Union of Concerned Scientists, OAR-2003-0012-0830 p. 2-4
Wisconsin Department of Natural Resources, OAR-2003-0012-0702, 0703 p. 3

Our Response:

We have decided to finalize the two-step approach today primarily because it enables the achievement of the greatest reduction in sulfate PM and sulfur dioxide emissions from nonroad, locomotive, and marine diesel engines as early as practicable. By starting with an initial step of 500 ppm sulfur we can achieve significant emission reductions and associated health and welfare benefits from the current fleet of equipment as soon as possible. In addition, the two-step approach provides for a more smooth and orderly transition to 15 ppm sulfur standard for NR and LM diesel fuel, by providing more time for refiners to develop the most cost-effective approaches, finance them, and then implement the necessary refinery modifications. Finally, by waiting until 2010 to drop to the 15 ppm sulfur standard for NR diesel fuel, the two-step approach harmonizes with the highway diesel fuel program by delaying the implementation of the 15 ppm sulfur standard for NR diesel fuel until the end of the phase-in period for 15 ppm sulfur highway diesel fuel. As a result, refiners are able to undertake both changes simultaneously, minimizing disruption and optimizing design.

The two-step program, with the initial step to 500 ppm sulfur fuel will provide refiners with an outlet for off-spec 15 ppm highway fuel during the period from 2007 to 2010. In addition, since the LM sulfur standard of 15 ppm does not go into effect until 2012, it also provides an outlet for off-spec 15 ppm fuel during the period from 2010 to 2012.

In response to IFTOA's comment regarding the Northeast, we note that the burden on these parties is not greater- it is in fact less. They have the choice to carry a third fuel, but they can always choose to eliminate high-sulfur heating oil as the rest of the country may do. We have further reduced the burden in the Northeast by eliminating the need for the heating oil marker there.

Regarding retrofit programs, the provisions that we are finalizing for early-credit fuel can be utilized earlier than the 2010 date for compliance with the ultra low sulfur standards. In addition, highway fuel will be available by June 1, 2006, and we do not believe that the limited volumes needed for retrofits will impact the supply of the highway market.

4.3.1.2 Oppose the Two-Step Approach (cross-contamination and misfueling issues)

What Commenters Said:

AEM commented that the proposed two-step approach may increase the opportunity for cross-contamination and misfueling. They further stated that allowing the supply of 500 ppm fuel to the nonroad market through May 2014 will increase the chances of misfueling, which in turn, creates concerns with respect to reduced engine durability and in-use compliance. (*Note: this oral testimony from AEM during the Chicago Public Hearing was modified in their written comments, OAR-2003-0012-0669--0670, as summarized above in 4.3.1.1. 'Support for the Two-Step Approach.'*)

Letters:
Chicago Public Hearing, A-2001-28, IV-D-06 [AEM p. 219]

Sunoco and UCS commented that while refineries can take steps to ensure that high and low sulfur diesel fuel supplies remain separate, distribution and marketing networks may have difficulty maintaining strict separations. Low sulfur diesel can be easily contaminated if it is stored in tanks that previously held higher sulfur fuels. The commenters stated that the best method for preventing cross-contamination is to hold all diesel fuels to a maximum sulfur level of 15 ppm at the same time. *[See additional discussion under Issue 8.1.1.]*

Letters:
Sunoco, OAR-2003-0012-0509 p. 1
Los Angeles Public Hearing, A-2001-28, IV-D-07 [UCS p. 70]

Houston, UCS, and Caterpillar commented that maintaining diesel fuel with different sulfur levels will increase the risk of cross-contamination. These commenters all expressed the belief that EPA should protect the gains made in the highway rule by holding all diesel fuels to 15 ppm starting in 2007. They further stated that the one-step approach will reduce the risk of cross-contamination and that the surest method for protecting emission controls from sulfur contamination is hold all diesel fuels, including highway, nonroad, locomotive, marine and heating oil, to a 15 ppm standard as soon as possible.

Letters:
City of Houston - Office of the Mayor, OAR-2003-0012-0630 p. 3
Union of Concerned Scientists, OAR-2003-0012-0830 p. 3
Los Angeles Public Hearing, A-2001-28, IV-D-07 [CAT p. 184; UCS p. 69]

Case-New Holland commented that EPA should not promulgate hardship provisions that would allow for the production and distribution of 500 ppm diesel fuel through May 2014. The commenter further stated that use of 500 ppm sulfur diesel fuel will create serious problems that reduce engine durability and cause in-use compliance concerns, and EPA should ensure that the final rule addresses these concerns.

Letters:
Chicago Public Hearing, A-2001-28, IV-D-06 [CNH p. 66]

Our Response:

Provisions for hardship, small refiner, and credit fuel mean that somewhat less than 100 percent of the total diesel fuel pool will meet the same standard on a given date. Furthermore, heating oil will continue. Therefore, a one-step program would not resolve all misfueling or contamination concerns. However, we have designed the two-step program in a way that will minimize these concerns.

Under the designate and track program, refiners and importers would designate the volumes of fuel they produce/import. These designations would follow the fuel through the distribution system. Further, all fuel will be accompanied by a product transfer document with the specific fuel designation on it. Fuel that is greater than 15 ppm sulfur content should be clearly identified, and thus should not be used in MY 2011 engines. In addition, fuel pump labels will be required to specify the respective grade of fuel, and this should help to limit concerns about misfueling for the time period where multiple grades of nonroad fuel are in the market.

We did not include specific misfueling provisions, such as nozzle size requirements, in the rule. This is partly because we are not aware of an effective and practicable scheme to prevent misfueling through the use of different nozzle sizes or shapes, but also because we do not believe that improper fueling will be a significant enough problem to warrant such an action.

Regardless of whether we adopted a one-step or two-step fuel program, by the time MY 2011 equipment (the equipment at risk of misfueling) is in the marketplace, 15 ppm diesel fuel will be the dominant fuel in the market, estimated to comprise about 80 percent of all number 2 distillate in 2010, and increasing to over 80 percent in 2012. In addition, we believe that 500 ppm diesel fuel will have only limited availability between 2012 and 2014. High-sulfur distillate for heating oil uses will remain, but will only exist in significant volumes in certain parts of the country. In any event, we believe that most owners and operators of new nonroad diesel engines and equipment will not risk voiding the general warranty and the emissions warranty by misfueling.

In the highway diesel fuel rule we did not finalize any provisions beyond fuel pump labeling requirements, though we recognized that some potential for misfueling could still exist. We expressed a desire to continue to explore with industry simple, cost-effective approaches that could further minimize misfueling potential such as color-coded nozzles/scuff guards. Since the highway diesel rule was promulgated, we have had discussions with fuel retailers, wholesale purchaser-consumers, vehicle manufacturers, and nozzle manufacturers, and continue to examine different methods for preventing accidental or intentional misfueling under the highway diesel fuel sulfur program. To date, affected stakeholders, including engine and truck manufacturers, truck operators, fuel retailers, and fuel nozzle manufacturers have not reached any common view whether the concerns over misfueling warrant any additional prevention measures. Expanding the 15 ppm pool to NRLM, however, reduces the opportunity for misfueling.

In response to Case-New Holland's comment, we are confident that the compliance assurance provisions being finalized today will solve these concerns. Refiners will have to designate all of their diesel fuel (type of fuel, sulfur level, volume, etc.) and the identification of the transferor at the point of delivery to a party in the distribution system. As the fuel is transported through the distribution system, it is similarly required to maintain a designation and product transfer document that accurately reflects its sulfur level. Any pump labels for the fuel must also clearly show the designated sulfur level. These labels match those required on the engine.

4.3.2 Baseline Approach versus Designate and Track

4.3.2.1 Baseline Approach

4.3.2.1.1 General

What Commenters Said:

<u>Support for Baseline Approach</u>

A number of commenters (NRDC, UCS, WI DNR) supported the baseline approach since it will ensure the enforceability and viability of the fuel standard. A baseline approach is preferred since it will be able to ensure that adequate supplies of each grade of highway and nonroad diesel fuel are available throughout the nation during the 2006 to 2010 timeframe. The baseline should be predictive enough to account for regular market fluctuations and flexible enough to enable the development of new markets. There are several objectives that should be met by the program, which include adopting an approach that maintains the benefits and program integrity of the highway diesel program, maximizing environmental benefits, ensuring adequate fuel supplies nationwide and the fungibility of highway and nonroad fuels, and using an implementation approach that is verifiable, transparent and enforceable. The designate and track approach is unlikely to meet these objectives, since it will place an enormous compliance burden on EPA and does not provide an opportunity for the public to evaluate the progress associated with implementation. In addition, the lack of any centralized information bank combined with each refiner's ability to designate each batch as it is produced would reduce EPA's ability to predict when and where low sulfur diesel is being delivered.

STAPPA/ALAPCO commented that based on their review of the alternatives, the baseline approach is the only alternative that would ensure that the standard is enforced and would ensure against any adverse effects to the highway diesel fuel program.

<u>Letters:</u>
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 24

Union of Concerned Scientists, OAR-2003-0012-0830 p. 4
Wisconsin Department of Natural Resources, OAR-2003-0012-0702, 0703 p. 3
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 10
New York Public Hearing, A-2001-28, IV-D-05 [STAPPA/ALAPCO p. 46]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [STAPPA/ALAPCO p. 27]
Chicago Public Hearing, A-2001-28, IV-D-06 [STAPPA/ALAPCO p. 39]
New York Public Hearing, A-2001-28, IV-D-05 [NRDC p. 34]

<u>Oppose Baseline Approach</u>

Many commenters (ConocoPhillips, Exxon, FHR, NACS/SIGMA, NPRA, Tesoro) believed that the baseline approaches could adversely interfere with the market and may create an anti-competitive environment. These commenters all stated that the proposed baseline compliance option is too restrictive because it would control production ratios of distillate fuels in an attempt to assure that adequate supplies of highway fuel are available. Even temporary baseline approaches could create an anti-competitive environment. These baselines will be established well in advance of any known changes in the market environment. Volume swings due to changes in contracts for distillate fuels exempt from the nonroad and highway rules would have a significant impact on a refinery operating under the baseline approach. Therefore, these commenters stated, EPA should examine alternatives to the proposed baseline approach that would take into account such changes in contract supply and demand.

Some commenters (API, p. 3; Exxon, p. 13; Marathon, p. 3) also stated that the compliance monitoring and reporting mechanism that EPA has proposed to ensure that the 80/20 ratio requirement is maintained could adversely affect the market. The baseline approach essentially requires the production of diesel fuel products in the same historical three-year proportions, which may be inconsistent with market demands. If EPA finalizes a baseline approach, refiners should be able to adjust the three-year 2003-2005 historical baseline to reflect the 2006-2007 capabilities of refiners modified to meet the requirements of the highway rule. This approach would minimize potential mismatches among early decade production ratios and potential changes in market demand later in the decade. *[See additional discussion below on mitigating the adverse effects of the baseline approach.]*

AOPL commented (pp. 4-12) that the baseline option attempts to create the desired fungibility for different types of fuel but only under certain conditions. Pipeline customers, refiners, and importers will find the baseline restrictions to be detrimental to their business. Other pipeline customers may not be bound by the baseline under the EPA's proposed rule. As a result, pipelines serving only one refiner (or only refiners that select the baseline) will benefit from more limited product streams, but the majority of pipelines that service many refiners and importers will be faced with supporting baseline and non-baseline refiners desiring to transport the full range of fuel options, thereby eliminating or reducing the benefit of the baseline approach. AOPL also noted that EPA's new on-road diesel rule combined with the proposed nonroad rule adopting the baseline and dye options would lead to 13 distillate grades requiring 12 separate batches for the interim 2007 to 2010 implementation period, provides a detailed summary table describing these products, and concludes that it will be difficult, if not impossible, for pipelines to carry all of these different products.

API and ExxonMobil (pp. 9 and 15, respectively) commented that baseline approaches may simply be unworkable. The alternative NRLM baseline that would have EPA assign a NRLM percentage of non-highway baselines to refineries based on the average for the PADD where they operate would severely restrict the ability of refineries to respond to market changes, particularly due to the intensity of seasonal or other short-term weather changes. The similar approach of defining a LM percentage baseline post 2010 in lieu of using a marker for LM has many of the same problems, although not as severe since it does not limit the production of heating oil. The commenters stated that, in general, if the additional burden of demonstrating compliance is sufficiently high, some refiners may opt to just dye their NRLM production and avoid the increased reporting burden associated with a baseline approach.

Many commenters (ExxonMobil, p. 13; IFTOA, p. 2; NEFI, p. 1; PMAA, p. 2; Sunoco, p. 2; Tesoro, pp.3-5) commented that a baseline approach would restrict the industry's ability to respond to market demand. For example, in the event of a cold winter, refiners and importers would be unable to increase the supply of home heating oil substantially. Even though EPA is considering small deviations from the baseline with appropriate compensation the following year, such a provision could not be adjusted to meet strong consumer demand during a crisis. In addition, as the natural gas shortage continues and prices remain high, it is reasonable to assume that during a cold winter, consumers with dual-fuel capability would switch to the lower priced fuel, which in recent years has been heating oil. These surges in demand could result in substantial price spikes and supply problems, which would only be exacerbated by the baseline program. These commenters all believed that if we were to decide to implement a baseline program, the production or importation of home heating oil should not be subject to the restrictions of an historical baseline. *[See additional discussion below on mitigating the adverse effects of the baseline approach.]*

ConocoPhillips commented (p. 2) that the baseline approach would provide the potential for 500 ppm NRLM diesel to be distributed into the highway market, which could discourage investment by refiners, particularly foreign refiners, resulting in less 15 ppm product than anticipated by the Agency in its highway rulemaking. The perceived degree of crossover of product could affect investment decisions that are based on projections of the 15 ppm demand and margin. This is a serious concern for refiners who are faced with making significant capital investments to produce 15 ppm diesel fuel. The highway diesel pre-compliance report results, which indicate ample supplies of 15 ppm diesel fuel in the necessary regulatory time frames may be considerably different in the next reporting cycle, especially if margins for the 15 ppm diesel product are compromised by crossover allowances in the NRLM rule.

The New England Fuel Institute (p. 2) commented that EPA's alternative baseline constrains the market. There are three main concerns associated with this alternative baseline. First, appropriate NRLM volumes cannot be accurately predicted and assigned. Second, the use of a credit system to permit increased production and imports of heating oil adds substantial cost to home heating oil. Third, deficit carryover of credits would not solve the problem since it is not certain that credits from the following season would be able to compensate for an unusually cold winter.

Tesoro commented (p. 4) that the baseline approach limits the ability of a refinery to address operational difficulties. In cases where a refinery experiences operational difficulties such as an exchanger leak, compressor problem, or hydrogen purification issue, they can generally still run safely but may not be able to produce diesel fuel to meet the 15 ppm specification. If repairs are lengthy, then a larger amount of 500 ppm fuel would be produced and sold. However, in order to meet the annual baseline requirement, a refinery may need to either slow down operations while repairs are scheduled or reduce total production of distillate for the rest of the year to ensure compliance.

ConocoPhillips (p. 4) commented that the proposed baseline approach creates confusion concerning how to account for kerosene volumes relative to the highway 80/20 requirement and for the NRLM baseline. This confusion would not be an issue under a designate and track approach. The confusion under the baseline approach is particularly true if the kerosene sulfur levels are greater than 15 ppm but less than 500 ppm (typical of No. 1 Kero), allowing it to be blended and sold into the 500 ppm highway diesel market. Since the kerosene product is shipped all-purpose, only a portion of the kerosene batch would actually end up in the highway market. Counting all of the volume as part of the 20 percent 500 ppm pool would be inappropriately constraining to the refinery.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 3, 9
Association of Oil Pipelines, OAR-2003-0012-0609 p. 4-12
ConocoPhillips, OAR-2003-0012-0777 p. 2-4
ExxonMobil, OAR-2003-0012-0616 p. 4-6, 12-13, 15
Flint Hills Resources, OAR-2003-0012-0667 p. 2
Independent Fuel Terminal Operators Association, OAR-2003-0012-0671, 0672 p. 2
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 3
National Association of Convenience Stores/Society of Independent Gasoline Marketers of America, OAR-2003-0012-0635 p. 3-4
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 9-10
New England Fuel Institute, OAR-2003-0012-0712, 0713 pp. 1-2
Petroleum Marketers Association of America, OAR-2003-0012-0606 p. 2
Sunoco, OAR-2003-0012-0509 p. 2
Tesoro, OAR-2003-0012-0662 p. 3-5
New York Public Hearing, A-2001-28, IV-D-05 [API p. 23]
New York Public Hearing, A-2001-28, IV-D-05 [AOPL p. 176]
New York Public Hearing, A-2001-28, IV-D-05 [NPRA p. 83]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [API p. 46]
Chicago Public Hearing, A-2001-28, IV-D-06 [API p. 90]
Chicago Public Hearing A-2001-28, IV-D-06 [BP p. 176; NACS/SIGMA p. 247; NPRA p. 18]

Our Response:

See the response under issue 4.3.2.1.2.

4.3.2.1.2 Suggested Improvements for Baseline Approach

What Commenters Said:

The Alliance commented that it supports the baseline approach, but recommended specific improvements:

- The baseline period of 2003 to 2005 may present a problem if refiners manipulate their production
- In establishing this baseline period, predictions should be based on the timing of publication of the proposed rule, not the final rule.
- To prevent refiners from manipulating production to the disadvantage of the highway ultra-low sulfur diesel market, the period should start one year earlier.

NRDC and others recommended several improvements and suggested allowances for the baseline approach:

- A 5 percent shortfall in the production of low sulfur diesel within a year (provided it is made up in the following year) should be allowed. This variance offers a reasonable level of production flexibility while maintaining a realistic overall projection of volume
- The proposed option that allows refiners wishing not to be limited to the non-highway distillate baseline percentage of production, to segregate and dye its fuel at the refinery gate should not be incorporated; as this would undermine the baseline approach and would add an unnecessary level of flexibility for the refiners.
- Refiners choosing the option to use the period June 1, 2006 to May 31, 2007 for calculation, should not be allowed to participate in the early NRLM credit program and would need to continue dyeing their fuel at the refinery gate until June 1, 2007 in order to present an objective set of numbers for analysis. The commenters believe that establishing the baseline with average volumes of over three years may limit refiners who have begun lowering their highway diesel production volumes for compliance with the fuel standards, and that the option for refiners could help reflect a more accurate picture of production volumes and capacity.
- The provision that allows for new or restarted refineries or new importers to be assigned a non-highway baseline percentage that reflects the projected average regional production of fuel in 2004 should be maintained.
- The cap on the use of credits at 25 percent of a non-highway baseline (less marked heating oil) is too high-- a 15 percent cap should be implemented instead
- Early credit provisions should not be created in the final nonroad diesel rule that have the potential to undermine the national availability of 15 ppm highway diesel fuel during the 2006 to 2010 timeframe. Credits awarded for 500 ppm fuel produced prior to June 1, 2007 should not be used to delay compliance with the 500 ppm NRLM standard in 2007 or the 15 ppm nonroad standard in 2010. In addition, EPA should not allow for the creation of credits for early production of 15 ppm fuel (prior to June 2009), since any such fuel could be treated as highway diesel fuel and the credits could be traded under the highway credit program.
- The baselines of refiners with multiple refineries and importers with multiple points of import should not be allowed to be aggregated on a nationwide basis. This could have a negative impact on the nationwide availability of 15 ppm sulfur highway diesel fuel from 2006 to 2010.

Tesoro provided the following suggestions for a baseline approach:

- A baseline percentage based on on-road diesel fuel production should be developed.
- Baseline percentages based on the facility's 2003-2005 on-road distillate production versus total distillate, or June 1, 2006 through May 31, 2007 total on-road distillate production versus total distillate should be derived.
- Refineries should be required to produce 15 ppm diesel equivalent to 68 percent of its baseline, which is derived from the requirement to produce 80 percent at the 15 ppm level and an adjustment factor of 85 percent. An adjustment factor is a critical safety margin for refineries that would provide needed flexibility to address market shifts and operational difficulties.

Wyoming Refining commented that the proposed definition of "Non-Highway Baseline

Percentage, B%" should be revised. The proposal defines the baseline as the percentage of diesel fuel and heating oil produced or imported during the baseline period that was dyed, which presents a problem that will make practical enforcement and compliance very difficult. Since diesel fuel is dyed when dispensed at the terminal, not at the refinery, the refiner producing exchanged diesel fuel and heating oil cannot control and does not know whether diesel fuel delivered on exchange is dyed when sold. Therefore, it is impossible to track fuel produced that is dyed. The problem in the proposed formula for the nonroad baseline percentage is that it requires comparing a volume that can only be determined from sales data (i.e. a sales volume with a production volume). Wyoming Refining provided suggested changes to the rule that will resolve this problem:

- It should be clarified that proposed Section 80.534(a) allows a refiner to use the off-highway baseline percentage provisions "in lieu of the dye requirements of Section 80.520(b)..", however, proposed Section 80.520(b) contains no dye requirements, only a prohibition against the presence of dye in on-highway diesel fuel and an acceptance of untaxed fuel that is dyed. This provision seems to stem from the misconception that all off road diesel fuel is dyed at the refinery. EPA's authority to change IRS rules on what must be dyed is limited.
- The purpose of the diesel fuel designation requirement of Section 80.523 should be clarified. It is unclear why this designation is required for diesel produced rather than diesel sold- this provision seems to stem from the misconception that all off road diesel fuel is dyed at the refinery. For refiners who will be producing nearly all 15 ppm diesel fuel starting June 1, 2006, there seems to be little purpose in requiring designations, off highway baseline percentages, or a 20 percent limit on downgrades.

Flint Hills Resources commented that the designate and track approach is highly preferred. However, they stated, as an alternative EPA could determine the percentage of NRLM sold in each PADD and apply that percentage to every refinery in the PADD. Credit sales could be used to better match specific areas in the PADD that have high or low NRLM usage with refineries that have corresponding capabilities.

API, BP, ConocoPhillips, ExxonMobil, Marathon Ashland, and NPRA commented that if we were to proceed with the baseline approach, it should be modified as follows to mitigate the resulting adverse impacts:

- Refiners should be allowed to establish baselines that reflect their operations from June 1, 2006 to May 31, 2007, in response to the requirements of the highway diesel rule.
- Seasonal flexibility should be provided in allowing refiners to meet a higher than normal heating oil demand.
- The aggregation of refiner baselines, nationally or by PADD, should be allowed.
- Refineries should be allowed to apply for adjustments to their highway and nonroad baselines in their annual compliance reports based on DOE/EIA forecasts of changes in demand for highway and non-highway diesel fuels.
- Refiners should be allowed to meet an alternative highway baseline.

In addition, API, BP, Marathon, and NPRA provided significant additional discussion on each of these potential modifications, concluding that the baseline approach may simply be unworkable and if implemented, should not be viewed as a precedent for future fuels regulations. NPRA commented that the baseline compliance options as a ratio of product blends sets de facto production volume limits since refiners are currently operating at or near capacity. NPRA also provided further discussion on the modification concepts above, specifically on providing seasonal flexibility for refiners and applying for adjustments to baselines based on demand change forecasts. NPRA also recommended that we allow a refinery to adjust its baseline if specific demands change due to the expiration of contracts for product purchased or for new business contracts for specific products, otherwise, potential customers will have undue leverage in any contract negotiations. Lastly, NPRA commented that to address the seasonal flexibility issue, we should allow for the nonroad baseline percentage to be exceeded at the refinery's discretion during the period from November 1 to March 31 of each year, provided that the increment of production above the normal baseline is all heating oil that is dyed and marked prior to sale. The incremental heating oil could be reported separately as "seasonal heating oil." BP added that refiners should have the capability to adjust the original nonroad baseline each year to reflect changes in contracts of distillate fuels exempt from the nonroad and highway rules; that refiners should be provided with the flexibility to comply with the nonroad distillate baseline, the dye and segregate option, or the highway baseline; and that an enforcement mechanism should be established for refineries electing to comply with either baseline approach. Without such an enforcement mechanism in place, BP stated, those refiners who made the necessary capital investments to make 15 ppm and 500 ppm highway diesel fuel would be at a distinct disadvantage to those who were in a position to produce, distribute, and market large volumes of 500 ppm nonroad diesel fuel into the highway market.

Letters:
Alliance of Automobile Manufacturers, OAR-2003-0012-0792 p. 3
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 6-8
BP, OAR-2003-0012-0649 p. 2-4
ConocoPhillips, OAR-2003-0012-0777 p. 7-8
ExxonMobil, OAR-2003-0012-0616 p. 4-6, 12-14
Flint Hills Resources, OAR-2003-0012-0667 p. 4
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 5-7
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 10-13
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 24-26
Tesoro, OAR-2003-0012-0662 p. 6
Wyoming Refining Company, OAR-2003-0012-0651 p. 3-4

Our Response (for 4.3.2.1.1 and 4.3.2.1.2):

We proposed the baseline approach because, in the absence of a red dye requirement at the refinery-gate for NRLM diesel fuel, we expected that it would allow for the fungible distribution of 500 ppm sulfur highway and NRLM diesel fuel, ensure the enforceability of the highway diesel fuel and NRLM diesel fuel standards, maintain the projected production volume of 15 ppm sulfur highway diesel fuel, allow refinery production of 500 ppm sulfur NRLM and heating oil to remain flexible to meet market demand, and enable the efficient distribution of diesel fuel while imposing the least burden on the parties in the fuel production and distribution system.

Of the options that were available at the time of the NPRM, we expected that the baseline approach would provide the best mechanism to achieve our fuel program goals. Since the proposal, we have comprehensively evaluated the advantages and disadvantages of both the baseline approach, including potential modifications, as well as the designate and track approach. Based on this review, we now believe that a baseline approach would produce significant adverse problems because of its overly restrictive impact on the ability of fuel producers and distributors to efficiently respond to the needs of the markets for NRLM (as well as highway) fuel. Its implementation would also appear to produce an unintended bias that would tend to reduce the benefits of the highway program and reduce the availability of 15 ppm highway diesel fuel. We found that a designate and track approach can be implemented in an enforceable manner and would not be expected to cause a reduction in the environmental benefits of the highway diesel fuel program, or adversely impact the widespread availability of 15 ppm highway diesel fuel. For these reasons, we have chosen to finalize the designate and track approach for today's fuel program.

For a more in depth response and discussion, please refer to section IV.D of the preamble to the final rule.

4.3.2.2 Designate and Track

4.3.2.2.1 Support for Designate and Track

What Commenters Said:

Many commenters supported the designate and track approach since it would eliminate restrictions imposed by the proposed baseline method. The designate and track approach is consistent with the current distribution system, which will be used more efficiently by shipping and storing two physically identical products together. The current distribution system already allows for the ability to track and differentiate between products and position holders of the same product. Pipelines currently use multipurpose product specifications to achieve the desired fungibility and the reduction in the grades handled is similar to what would be possible under the designate and track approach. The current approach allows pipelines to commingle products with similar specifications and simply track volumes to assure compliance. Using industry volumetric accounting procedures, products are tracked from the origin receipt to the delivery point, which may be the terminal truck rack for some pipelines. Regular gasoline, certain brands of premium gasoline, and jet fuel (both domestic and bonded) are moved fungibly within pipelines. Pipelines meter product coming into and out of the system both as to ownership and specifications. All affected parties rely on the pipeline's meter, which is regularly proved for accuracy. Pipelines then conduct an inventory assessment to track both the ownership and quantities of these products that are commingled. This assessment entails balancing the opening inventory against the closing inventory, taking into account the products received into the system against the products delivered out of the system. Pipelines are accountable to their customers and settle any differentials on a monthly basis. Product volume accounting and frequent metering is used, which could be provided to EPA quarterly and reconciled annually. Pipelines also require origin Certificates of Analysis (COA) and perform routine oversight testing as batches move through the system to ensure that appropriate specifications are maintained. These records can also be provided to EPA on a monthly basis.

Some commenters stated that while monitoring fuel movements through the system is somewhat more burdensome on EPA, it is quite feasible using electronic reporting mechanisms. With electronic reporting and potential electronic screening, EPA could screen results or review a representative sample of reports to determine and focus enforcement efforts as necessary. Only modest upgrading of recordkeeping software would be necessary to ensure that this approach is fully workable. In addition, the designate and track approach allows refiners to supply fuels to the market as needed, does not push preset ratios of product into the marketplace in the hope that they will somehow match up with demand,

and eliminates the potential for more supply disruptions and market volatility. The designate and track approach may be unenforceable if noncompliance were the norm, but pipeline and terminal operators will continue to make the best effort to comply with the standards. Commenters provided additional discussion on this issue, including a description of how products are already being tracked throughout the transportation network and how a designate and track approach would be incorporated into the existing system, and recommended that EPA include the designate and track approach as a third option during the three year phase-in period. One commenter (Citgo) noted that designate and track should be the only option since multiple options add unnecessary complexity and would likely require a pipeline to select either the baseline or designate and track method. This commenter provided additional details and discussion regarding the logistical, recordkeeping and reporting, and enforcement issues that were raised by EPA in the proposed rule and would need to be addressed under a designate and track approach.

Additionally, API, Citgo, and Marathon commented that the designate and track approach should be used since it will be accepted by the industry. They commented that the relative reporting burden imposed for dyeing versus the baseline approach to demonstrate compliance is quite large, and that given the choice between the current proposed baseline approach and dyeing the fuel, most refiners will opt for the dye approach. The commenters believe that the baseline approach is too inflexible and creates a situation where a refiner may be forced to downgrade 500 ppm diesel to a limited heating oil market. Using a dyed approach will eliminate most of the highway 500 ppm diesel in the market since storage will be limited. The overall diesel supply system will need the volume of 500 ppm highway and nonroad diesel that a fungible distribution alternative can facilitate.

IFTOA commented that the designate and track program would not necessarily impose a huge enforcement burden on the EPA (as some supporters of the baseline approach commented). IFTOA believes that refiners and importers should be required to maintain appropriate volumetric records of on- and off-road diesel fuel. They also commented that compliance determined by volume in and out of the facility would simplify the process substantially. Lastly, IFTOA stated that under the IRS EXSTARS program, terminals are currently required to report and maintain records of all products entering and leaving the facility; to fit with this program, refiners and importers could simply grant permission to the IRS to allow their monthly reports to be shared with the EPA.

Citgo and NPRA specifically commented that the designate and track approach should be adopted as it is a sound and prudent concept that is directly applicable to the fungible shipment of 500 ppm diesel fuel and to enforcement. Even with a baseline approach, there will still be a requirement to have a designate and track program. The adoption of a baseline compliance strategy will not eliminate perceived enforcement problems posed by the designate and track approach. Under the baseline approach, it will still be necessary to track volumes of baseline, undyed NRLM diesel for the purpose of compliance verification. As a result, the refining industry would end up with mandated baseline compliance plus the designate and track approach, and EPA would still need to track product throughout the system.

SIGMA/NACS commented that the designate and track mechanism would permit EPA to achieve the environmental goals of the off-road program and preserve the integrity of the on-road program while at the same time permitting refiners, pipelines, and bulk suppliers with maximum flexibility to respond to market demands and supply disruptions.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 2-4, 21

Association of Oil Pipelines, OAR-2003-0012-0609 p. 4-12
Citgo Petroleum Corporation, OAR-2003-0012-0707 p. 3-8
ConocoPhillips, OAR-2003-0012-0777 p. 2
ExxonMobil, OAR-2003-0012-0616 p. 4-6, 11-12
Flint Hills Resources, OAR-2003-0012-0667 p. 2-4
Independent Fuel Terminal Operators Association, OAR-2003-0012-0671, 0672 p. 3
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 3-4, 13
National Association of Convenience Stores/Society of Independent Gasoline Marketers of America, OAR-2003-0012-0635 p. 3-4
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 7-10
Petroleum Marketers Association of America, OAR-2003-0012-0606 p. 2-3
Sunoco, OAR-2003-0012-0509 p. 2
Tesoro, OAR-2003-0012-0662 p. 4-5
Williams Energy Partners, OAR-2003-0012-0626 p. 3
New York Public Hearing, A-2001-28, IV-D-05 [API p. 24; AOPL p. 177]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [API p. 48]
Chicago Public Hearing, A-2001-28, IV-D-06 [API p. 92-94]

Colonial Pipeline commented that even though there are some compliance issues associated with the designate and track approach, it can be a viable option. EPA should implement this approach and should remove any marker requirements, which will eliminate concerns associated with jet fuel contamination, test method accuracies and compatibility. In considering the compliance issues associated with a designate and track approach, EPA should consider establishing a clearinghouse for party-to-party volume reconciliation and a range of tolerance for gains and losses. EPA should also examine the possible use of Product Transfer Documents (PTDs), which would allow for the removal of marker requirements.

Letters:
Colonial Pipeline Company, OAR-2003-0012-0694 p. 2

Citgo and FHR commented that the designate and track approach would not reduce the volume of 15 ppm fuel required to be produced under the highway program. If a refinery invests in the capital to produce 15 ppm highway fuel, they will maximize production regardless of which approach is used. Also, there are safeguards in place with the current tracking system that will prevent refineries from "cheating" and using NRLM diesel for 500 ppm highway diesel. In addition, a designate and track approach will not reduce spillover volume since it is primarily driven by logistic constraints. There are some pipelines and terminals where it does not make sense to carry two grades of diesel, and economics dictate installing red dye injection systems and providing only low sulfur diesel to the terminal to be used for both highway and nonroad diesel sales. The same will be true in the future. Lastly, the commenters stated that the designate and track approach is not a factor in capital decisions on whether or not to invest for the production of 15 ppm highway diesel fuel.

Letters:
Citgo Petroleum Corporation, OAR-2003-0012-0707 p. 5
Flint Hills Resources, OAR-2003-0012-0667 p. 2-4

Our Response:

As stated above in 4.3.2.1, we are finalizing the designate and track approach today in lieu of the proposed baseline approach. In addition to the comments we received regarding the two approaches, we also had many discussions with various parties throughout the fuel distribution system, which led us to believe that the designate and track approach is the preferred method, as many parties are already designating/tracking fuel as a part of their normal business operations. They stated that only modest upgrades in their recordkeeping procedures would be needed to compile the needed information and that preparing the necessary reports would not represent a significant burden. Thus, our concerns that a designate and track approach might represent a large burden to fuel distributors were unfounded. In addition, we believe that we have developed appropriate solutions to the various open questions and issues with the designate and track approach from the proposal, and that this approach can be designed to meet the enforcement and compliance assurance needs of today's rule. Section IV.D of the preamble contains a complete discussion of the rationale of our decision to finalize the designate and track approach.

A complete discussion of the designate and track provisions that we are finalizing today is located in section IV.D.3 of the preamble. The basic program is as follows:

- First, refiners will have to designate all of their diesel fuel at the point they deliver it to a party in the distribution system.
- When custody of a volume of fuel is transferred to the next person in the distribution system, the transferor would again designate (in the product transfer document) the fuel that they deliver.
- The designation a party makes for fuel that it delivers has to be accurate, e.g. fuel designated as 500 ppm NRLM has to meet that sulfur level.
- As long as certain volume balances are maintained over the required time period, parties in the distribution system are free to re-designate the diesel fuel in any way that is accurate (e.g. 500 ppm NRLM that is received can be redesignated as heating oil when you deliver it, 500 ppm NRLM can be redesignated as highway, and so on).
- In general, the designate and track requirements stop when the diesel fuel has been taxed as highway diesel fuel, dyed as NRLM, or marked as heating oil.

Further, there are various record keeping and reporting provisions to ensure that the required volume balances are maintained. Parties in the refining, importing and distribution system will register with EPA and receive numbers that identify themselves and their facilities, and these ID numbers will be used in tracking the fuel. By comparing the volumes that each party reports as delivered or received to the reports of other parties in the system, we will be able to quickly verify whether the required volume balances have been maintained.

We considered utilizing IRS records and the IRS EXSTARS reporting system as a basis for our designate and track program. However, difficulties in access to IRS records, and differences in the fuels being tracked, prompted the need for a separate program. However, there may be opportunities for both Agencies to benefit from each others' programs in the future.

4.3.2.2.2 Oppose Designate and Track

What Commenters Said:

Some commenters (NRDC, UCS, WI DNR) believed that the designate and track approach is unlikely to meet specific objectives which should be achieved. These objectives include: adopting an approach that maintains the benefits and program integrity of the highway diesel program, maximizing environmental benefits, ensuring adequate fuel supplies nationwide and the fungibility of highway and nonroad fuels, and using an implementation approach that is verifiable, transparent, and enforceable. The commenters believe that the designate and track approach will place an enormous compliance burden on EPA and does not provide an opportunity for the public to evaluate the progress associated with implementation. They added that the lack of any centralized information bank combined with each refiner's ability to designate each batch as it is produced would reduce our ability to predict when and where low sulfur diesel is being delivered.

The Alliance and CARB commented that the designate and track approach may not be feasible given the complexity associated with this approach and the potential for misfueling, and may create problems with fuel supply, verification, and enforcement. CARB also noted that several problems may arise from using the designate and track approach: (1) all distributors receiving marked and unmarked fuel from the refinery would be required to document where the fuel was to be used, which would mandate the creation of an infrastructure just to process the reports and track fuel sales and usage to assure compliance in a timely manner; (2) it would be difficult to enforce given the number of entities involved in the bookkeeping process; and, (3) if distributors overextend the allocation of diesel fuel to one sector over another, widespread disruption of the fuel supply could result. CARB concluded that we should adopt the fuel distribution proposal which would leave allocation in the hands of the refiners as a more verifiable and enforceable approach.

The Clean Air Task Force, et al (including PIRG and the American Lung Association) commented that the main problem with the designate and track approach is the lack of accountability. Once the fuel is produced, designated, and leaves the refinery gate, the refiner would have no further liability in the event that the fuel finds its way into a market different from that for which it was designated. The responsibility would instead lie with the multitude of other actors in the fuel distribution system that otherwise are not substantially and directly affected by the nonroad proposal. If a refiner believes that the baseline approach overly restricts its marketing flexibility, then it can elect to continue to dye its nonroad diesel fuel, as it has been since 1993.

Letters:
Alliance of Automobile Manufacturers, OAR-2003-0012-0792 p. 2
California Air Resources Board, OAR-2003-0012-0644 p. 6-7
Clean Air Task Force, et. al., OAR-2003-0012-0508 p. 21
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 24
Union of Concerned Scientists, OAR-2003-0012-0830 p. 4
U.S. Public Interest Research Group, OAR-2003-0012-0780 p. 2
Wisconsin Department of Natural Resources, OAR-2003-0012-0702, 0703 p. 3
New York Public Hearing, A-2001-28, IV-D-05 [CARB p. 141]
New York Public Hearing, A-2001-28, IV-D-05 [NRDC p. 34]
New York Public Hearing, A-2001-28, IV-D-05 [ALA p. 111]
Chicago Public Hearing, A-2001-28, IV-D-06 [ALA p. 285]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [CARB p. 14]

Our Response:

Many of the concerns with the designate and track approach that commenters raised are those highlighted by EPA in the proposal. Subsequent to the proposal, however, we have developed many mechanisms to minimize or eliminate these concerns. Conversely, during discussions with representatives from the fuel industry, new concerns were raised with the baseline approach which defied effective resolution. After careful review of both the designate and track and baseline approaches, we have concluded that the designate and track is the approach that will best meet our program objectives. Please see section 4.3.2.1 above, and section IV.D of the preamble, for further discussion on this issue.

4.3.3 Dyes and Fuel Markers

4.3.3.1 Use of Dyes at the Refinery Gate

What Commenters Said:

API and Marathon commented that the use of red dye to distinguish products and detect contamination is an effective solution to ensure compliance. The compliance tracking issues downstream of wholesale terminals concerning heating oil (2006-2010) and locomotive marine (2010-2014) are unique due to current IRS regulations regarding the use of red dye.

<u>Letters:</u>
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 13
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 9
New York Public Hearing, A-2001-28, IV-D-05 [API p. 23]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [API p. 44]
Chicago Public Hearing, A-2001-28, IV-D-06 [API p. 87]

API and Marathon also commented that EPA should establish a mechanism that would allow for the fungible shipment of 500 ppm highway and nonroad diesel; therefore, they stated, the option to dye NRLM at the refinery gate should be maintained as an alternative. The commenters believed that this would be essential to minimize the stress on the downstream distribution system and facilitate the actual distribution and availability of low sulfur diesel after 2006.

<u>Letters:</u>
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 2-3
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 3

CHS commented that allowing for some flexibility may be helpful and may reduce costs and the enforcement burden since the use of dyes or other markers for offroad diesel is complicated by the fact that two 500 ppm fuels will exist simultaneously in the distribution system for several years. CHS also expressed their support for the use of Solvent Yellow 124 in home heating oil.

<u>Letters:</u>
CHS Inc., OAR-2003-0012-0785 p. 3

CHS also commented that allowing for voluntary dyeing at the refinery appears to be inconsistent with the approach that would use dyed fuel at the gate for setting baselines. EPA should reevaluate how baselines are established in the context of the use of dyes. EPA's approach for determining the nonroad baseline percentage for each refinery may not work if refiners would have the option of dyeing at the gate, especially if the refiner only makes 15 ppm diesel. The formula for setting a baseline using dyed fuel at the gate appears to negate the voluntary aspect of the dyeing.

Letters:
CHS Inc., OAR-2003-0012-0785 p. 3

Wyoming Refining commented that the assumptions regarding the use of dyes in the distribution system are incorrect. The proposal indicates a belief on the part of EPA that all nonroad diesel fuel is currently dyed at the refinery, that nonroad diesel fuel is always dyed before being transported by pipeline, and that all refiners can track how much of their production is eventually dyed as nonroad diesel fuel. These erroneous assumptions have led EPA to propose rules governing fuel distribution and segregation that are unworkable and unenforceable. *[See additional discussion under Issue 4.3.1.]*

Letters:
Wyoming Refining Company, OAR-2003-0012-0651 p. 2-3

Our Response:

In place of the refiner baseline approach, we are finalizing a designate and track approach, as discussed above in 4.3.2. Under this approach, refiners/importers will identify whether their diesel fuel is highway or NRLM and the applicable sulfur level. They may continue to dye their NRLM as they currently do today, so there is visible evidence of the dye. However, the designate and track provisions were specifically designed to allow them to mix and fungibly ship highway and NRLM diesel fuels meeting the same sulfur specification without dyeing their NRLM diesel fuel at the refinery gate. The volume designations will follow the fuel through the distribution system with limits placed on the ability of downstream parties to change the designation. Only at the terminal will NRLM have to be dyed, just as it is today for IRS tax purposes. We believe that this approach will be the most useful for refiners and importers, as it allows them to fungibly ship fuel meeting the same specification, rather than having to separate non-dyed highway and dyed NRLM if we had finalized a provision to dye fuel at the refinery gate. Further, in discussions with refiners and other parties in the distribution system, it was generally stated that the requirement to dye NRLM fuel at the refinery gate would also have require the segregation of highway and NRLM fuels meeting the same specification.

4.3.3.2 Use of Fuel Markers

What Commenters Said:

API and Marathon commented that they do not oppose the use of a separate marker for heating oil during the unique transitions of the nonroad proposal since it may discourage and allow for the detection of misuse of fuels downstream of wholesale terminals, but note that the value of its use should be assessed against its potential quality impact and feasibility.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 13

Marathon Ashland, OAR-2003-0012-0826, 0827 p. 9
New York Public Hearing, A-2001-28, IV-D-05 [API p. 23]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [API p. 44]
Chicago Public Hearing, A-2001-28, IV-D-06 [API p. 87]

CHS expressed support for the use of Solvent Yellow 124 in home heating oil.

Letters:
CHS Inc., OAR-2003-0012-0785 p. 3

IFTOA and PMAA commented that the use of a chemical marker to distinguish between nonroad, locomotive and marine fuel and heating oil is simply unnecessary. They further commented that widely available technology to test the sulfur content of fuel should be used. Lastly, they stated that simple enforcement procedures can more effectively and efficiently prevent the use of heating oil in nonroad applications than the use of an expensive marker that requires equally expensive equipment to detect.

Letters:
Independent Fuel Terminal Operators Association, OAR-2003-0012-0671, 0672 p. 4
Petroleum Marketers Association of America, OAR-2003-0012-0606 p. 1

IFTOA, NORA, NEFI, and PMAA commented that we should not require the use of a fuel marker since this approach would result in a loss of flexibility for terminal operators and could have an adverse effect on fuel supplies. Independent terminals that are located in remote rural areas often only have the capacity to store and market two fuels; on-highway diesel fuel and home heating oil. To meet the needs of a nonroad marine or locomotive customer, a terminal could blend the two streams to achieve a 500 ppm fuel. However, the use of a marker in the heating oil would preclude such blending. Therefore, the use of a marker would restrict flexibility and would make it impossible for some terminals to respond to consumer demand. One commenter (NORA) noted that blending 15 ppm product with heating oil is often the most cost-effective approach for delivering 500 ppm sulfur fuel.

Letters:
Independent Fuel Terminal Operators Association, OAR-2003-0012-0671, 0672 p. 4
National Oilheat Research Alliance, OAR-2003-0012-0840 p. 2
New England Fuel Institute, OAR-2003-0012-0712, 0713 p. 3
Petroleum Marketers Association of America, OAR-2003-0012-0606 p. 1-2

The use of a fuel marker will have an adverse effect on the ease of alternating the use of the NRLM dyed fuel with the 500 ppm fuel. If a marketer alternates filling their tanks between nonroad diesel containing red dye and clear onroad diesel without cleaning the tanks and lines, contamination occurs. This same issue will occur with yellow dye and during the winter months, this issue will affect a marketer's ability to supply fuel to customers in a timely manner. In addition, the use of a fuel marker will have an adverse impact on marketers who sell both nonroad diesel and heating oil since they will be forced to purchase extra tankage and trucks if they want to sell the NRLM dyed fuel, which is highly impractical due to the costs involved.

Letters:
Petroleum Marketers Association of America, OAR-2003-0012-0606 p. 2

NORA commented that the marking system proposed by EPA will help with the implementation of an averaging, banking and trading (ABT) program for refiners producing low sulfur fuel for off-road (other than heating oil) applications. However, a mandated marking system will be very costly and the effectiveness of an ABT program to reduce these costs is uncertain at this time. *(See Issue 6.4.4 for additional discussion on the costs associated with the use of a fuel marker).*

Letters:
National Oilheat Research Alliance, OAR-2003-0012-0840 p. 1

NORA also commented that any marking system should only be implemented after all the risks to the homeowner and the environment from the proposed marker have been fully evaluated. Even though the EU has used the proposed marker for a year, EPA should release all additive testing and toxicological tests of all constituents and should provide an opportunity for comment on those tests prior to the finalization of the rule.

Letters:
National Oilheat Research Alliance, OAR-2003-0012-0840 p. 1-2

NORA further commented that the program of marking heating oil could undermine efforts to encourage a low sulfur fuel for heating oil and thus the environmental achievements of organizations such as NORA, which has invested considerable effort into a voluntary conversion to 500 ppm fuel. Even though it appears that EPA's efforts could enhance the distribution of this product, the marking requirement will require terminal operators to decide whether they will mark the heating oil and incur a capital expense or forego marking the fuel and limit their ability to import high sulfur heating oil (and thus commit to selling fuel with a sulfur content of 500 ppm or less). Unanticipated changes in demand based on conditions such as a colder than normal winter season can require substantial imports to keep the market in balance and to impose a marking system would limit the ability of refiners to blend higher sulfur imported fuels with lower sulfur diesel to meet the overall demand. Commenter (NORA) provides additional discussion on this issue noting that EPA's proposed marking system would impact both current residential consumers of heating oil as well as all energy users since heating oil serves as a backup system for both natural gas and electricity. *(See Issue 6.4.4 for additional discussion on the costs that refiners will face in order to distribute marked fuel).*

Letters:
National Oilheat Research Alliance, OAR-2003-0012-0840 p. 2

Our Response:

Given our decision to finalize reducing the sulfur in locomotive and marine fuel to 15 ppm in 2012 (2014 for small refiner fuel), the addition of a marker to locomotive and marine diesel fuel after 2012 is no longer necessary to successfully enforce the program. However, the marker will be required in LM fuel in the 2010 - 2012 timeframe.

To prevent shifting heating oil into the NRLM market, we proposed that a fuel marker be added to heating oil at the refinery gate, and that the presence of the heating oil marker in NRLM diesel fuel would be strictly prohibited, this would be similar to red dye requirements for high sulfur diesel fuel that were implemented in 1993 to prevent its use as highway diesel fuel subject to the then applicable 500 ppm sulfur standard. We proposed that the marker be added at the refinery gate rather than at the terminal for three additional reasons. First, this seemed to be the least costly and most efficient way to add the marker given that the number of terminals is far greater than the number of refineries.[17] Second, marking heating oil as it is introduced into the distribution system would ensure that high sulfur small refiner and credit NRLM fuel could be differentiated from heating oil at any point in the system. Third, under the proposed baseline approach there was no true way to ensure that heating oil was not shifted into the NRLM pool during distribution from the refinery/importer to the terminal.

The comments summarized above, as well as discussions with various parties throughout the fuel distribution system raised several concerns. These concerns were with jet fuel contamination, the costs for segregating marked heating oil in the distribution system, and overall costs. Since we are finalizing the designate and track approach, we believe this will alleviate these concerns about the use of the heating oil marker. By extending the designate and track approach to high sulfur NRLM diesel fuel and heating oil, these otherwise identical fuel grades can be tracked down to the terminal, and the marker then can be added at the terminal- at the same point where dye is added for IRS purposes- instead of at the refinery gate. Since it is not feasible to go beyond the terminal with designate and track, given the breadth and nature of the entities involved, the marker will still be required downstream of the terminal (this includes heating oil). Shifting the point of marker addition downstream to the terminal eliminates any significant opportunity for jet fuel contamination. See issue 10.1.2.2. for additional discussion re marker contamination concerns. Shifting the point of marker injection to the terminal also addresses the segregation issues raised by fuel distributors. The marker will no longer hinder the fungibility and ability to mix different products with heating oil upstream of the terminal.

However, discussions with terminal operators in the Northeast, and other representatives of heating oil users and distributors, revealed concerns that shifting the point of the heating oil marker injection to terminals would represent a substantial burden. Terminal operators stated that the cost of installing new injection equipment would be burdensome to them, the cost of the marker would be significant given the large volume of heating oil used in the Northeast, and the marker requirement was not needed in the Northeast since neither small refiner nor credit NRLM would be used in this area. After taking this into consideration, we modified the refiner flexibility provisions in the final rule such that we could avoid the need for the marker entirely in the Northeast, Mid-Atlantic states, and Alaska where the majority of all heating oil is expected to continue to be sold. By doing so we have greatly reduced the cost and burden of the marker provisions from the proposal. NORA's concern that the heating oil marker requirement might discourage the use of 500 ppm fuel for heating purposes was predicated on the idea that once a terminal had invested in marker injection equipment, it would have an incentive to continue marketing high sulfur heating oil. Today's rule minimizes the number of terminals that will need to install such injection equipment and the volume of heating oil that will need to be marked, thereby mitigating this potential concern. A further discussion of fuel markers is located later in chapter 10 of this Summary and Analysis.

We projected that as many as 1,000 bulk plants who previously handled only high sulfur fuel for sale into both the nonroad and heating oil markets will need to install an additional storage tank and demanifold 3 tank trucks on average (converting from a single to two storage compartments per truck) in order continue supplying both the nonroad and heating oil markets after the implementation of today's

[17]Additional injection equipment will be required to inject the heating oil marker.

rule (See Chapter 7.4 of the RIA). We believe that the $120,000 cost per bulk plant, although significant, will be manageable. When the distribution areas of two bulk plants overlap, such bulk plants may have the option of entering into an exchange agreement so that they can continue to supply both the heating oil and nonroad markets without the need to install an additional storage tank. Alternately, the bulk plant operator could switch their storage tank from heating oil service in the winter to nonroad diesel fuel service in the summer (contamination concerns are discussed below). We expect that the implementation of today's rule will not result in the need for additional storage tanks or tank trucks at bulk plants beyond that discussed above.

We anticipate that due to the Northeast/Mid-Atlantic Area provisions in today's rule (see Section IV.D. of today's preamble) few bulk plants will be faced with the choice of carrying marked heating oil. Heating oil used in the Northeast/Mid-Atlantic Area and Alaska does not need to contain the heating oil marker. After the implementation of today's rule, the vast majority of all heating oil in the U.S. will be used in the Northeast/Mid-Atlantic Area. We expect that what heating oil remains outside of the Northeast/Mid-Atlantic Area will be distributed directly from the refinery rack. Thus, only a limited number of bulk plants outside of the Northeast/Mid-Atlantic Area will have access to heating oil and be faced with potential concerns regarding limiting marker contamination of nonroad diesel fuel.

In situations where a bulk plant operator might use a stationary storage tank for marked heating oil in the winter and nonroad fuel in the summer, we expect that the bulk plant operator could avoid marker contamination of nonroad diesel fuel by switching to unmarked nonroad fuel prior to the end of the heating oil season. By doing so, we believe that the tank could be turned over sufficiently so that what ever marked heating oil might remain would not be sufficient to result in a concentration greater than the 0.01 mg/liter threshold below which the presence of the marker in nonroad diesel fuel is not considered a violation under today's rule. Switching compartments on tank trucks from marked heating oil service to nonroad diesel service could be more readily accomplished. We anticipate that upon completely emptying the tank compartment, the tank compartment and fuel delivery system could be flushed of any residual marked heating oil with nonroad diesel fuel (that could then be sold as heating oil).[18]

4.3.3.3 Kerosene

What Commenters Said:

API, Colonial, Marathon, and ExxonMobil commented that kerosene intended for off-road use should not be dyed. In Section 80.520, EPA proposes to require all kerosene not used in jet aircrafts to be dyed, with the only exception being the kerosene in the refiner's 80/20 temporary compliance as 500 ppm highway diesel fuel or in the baseline compliance option as non-highway volume. This requirement creates some major complications. First, many states currently do not allow the use of red dye in kerosene and EPA's proposal will create a conflict with State requirements. Second, many fuels are shipped under multipurpose specifications to create the greatest flexibility in the distribution system, and the inclusion of the "for use only" comment would have an adverse impact on the production, movement,

[18] Depending on the applicable downstream sulfur standard for nonroad diesel fuel (See Section IV.A. of today's preamble), this process may also be necessary to ensure that the nonroad diesel fuel is in compliance sulfur standard.

and distribution of jet fuel, kerosene, and winterization volumes of 500 ppm diesel. Third, beginning with the winter of 2006/2007, some amount of 15 ppm kerosene will be needed for winter blending with highway 15 ppm diesel and requiring this material to be dyed would preclude its intended use. API and Marathon further recommend that EPA allow for the continued use of multipurpose kerosene for K-1 kerosene, jet fuel, and winterization of 500 ppm highway diesel by allowing the movement of this fuel undyed and the removal of the term "for use only" specifically for jet fuel.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 16
Colonial Pipeline Company, OAR-2003-0012-0694 p. 3-4
ExxonMobil, OAR-2003-0012-0616 p. 17
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 10

AOPL and ConocoPhillips commented that when kerosene is blended with off-road diesel, it is dyed at the terminal to meet IRS excise tax standards. If it is sold as aviation fuel or K-1 kerosene, it cannot be dyed since the aviation industry and the Kerosene Heater Association are concerned about additives that may affect engine or heater performance. If EPA imposes a requirement that kerosene be dyed, any pipeline moving that fuel must do so as a separate batch, resulting in more interface and a need for additional separate tankage. The seasonal nature of this product and the relatively small volumes used will certainly limit the number of pipelines willing to handle it. EPA should permit kerosene for any purpose to be carried in a fungible batch with the end-use being appropriately designated and tracked through the distribution system for compliance. ConocoPhillips recommended that we work with the FAA and others to assure that widespread use of ultra-low sulfur kerosene in jet aircraft does not have any adverse consequences.

Letters:
Association of Oil Pipelines, OAR-2003-0012-0609 p. 17
ConocoPhillips, OAR-2003-0012-0777 p. 4

ConocoPhillips commented that dyeing the multi-purpose kerosene stream at the refinery gate is not an option due to dye restrictions for jet fuel and kerosene used in space heaters, etc. In order to continue to ship multi-purpose kerosene undyed, the refiner would either have to count the volume in their diesel production (i.e. toward the 80/20 requirement), include it in their NRLM baseline, or ship the entire volume as jet fuel. The kerosene distributed from the terminal would have product transfer documents that would indicate the sulfur level, which prevents cross-contamination. EPA must re-examine this kerosene issue. Since the actual volumes that are used in diesel are relatively small, EPA should consider excluding undyed kerosene from the refinery's highway 80/20 compliance calculations.

Letters:
ConocoPhillips, OAR-2003-0012-0777 p. 4

ExxonMobil commented that it supports the proposed sulfur content restrictions for kerosene and additives.

Letters:
ExxonMobil, OAR-2003-0012-0616 p. 22

Our Response:

We have modified the provisions for the final rule to avoid a dye requirement for kerosene. Furthermore, we have designed the designate and tracking provisions to allow for the continued wintertime blending of kerosene without undermining the enforceability of the provisions that are being finalized.

4.4 Small Refiner Provisions

4.4.1 General Support

What Commenters Said:

Some small refiners and others commented that they support the proposed small refiner provisions. The small refiners commented that they are at a financial disadvantage because of the higher production costs per gallon and severe financing restraints; it is difficult for small refiners to raise capital through earning or borrowing, and they are unable to secure capital from the normal lending markets or from their owners. Countrymark also commented that it is particularly difficult for cooperatives to raise the necessary funds to make the improvements to the refinery to allow for the removal of sulfur from fuels. Small refiners do not have the economies of scale that large refiners do, and they cannot allocate costs or losses to other, more profitable segments of their business.

Letters:
Colorado Department of Public Health and Environment, OAR-2003-0012-0687 p. 2
Countrymark Cooperative, OAR-2003-0012-0602 p. 1
Frontier Oil Corporation, OAR-2003-0012-0621 p. 1
Small Refiners Coalition, OAR-2003-0012-0754 p. 2
Texas Commission on Environmental Quality, OAR-2003-0012-0716, 0717 p. 1
Western States Air Resources Council, OAR-2003-0012-0711 p. 2
New York Public Hearing, A-2001-28, IV-D-05 [Gary-Williams p. 67]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [Countrymark p. 98]

Some small refiners also commented that they do not have in-house research, engineering or construction departments and do not have ongoing relationships with independent engineering firms and large contractors who specialize in refinery construction. As a result, small refiners will need much more time than the larger refiners to arrange for outside engineering and construction. EPA should maintain the small refiner provisions in the proposed rule that allow for that extra time.

Letters:
Countrymark Cooperative, OAR-2003-0012-0602 p. 1
New York Public Hearing, A-2001-28, IV-D-05 [Gary-Williams p. 67]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [Countrymark p. 99]

Gary-Williams commented that the small refiner provisions are necessary since the cost of compliance for these refiners are significant. The refiner estimated that it will cost more than $45 million to revamp their refinery's hydrocracker unit and install the necessary ancillary equipment to provide 15 ppm motor vehicle diesel fuel, which is more than twice what was paid for the refinery in 1995. Gary-Williams further added that increased operating costs are estimated to be about $5 million a year, and that to desulfurize gasoline to the new national standard will require additional capital investment of about $20 million, bringing their total capital commitment for compliance with these fuel desulfurization rules to almost $70 million.

Letters:
Gary-Williams Energy Corp., OAR-2003-0012-0753 p. 2-3
New York Public Hearing, A-2001-28, IV-D-05 [Gary-Williams p. 67]

Our Response:

We agree that small refiners have an inherent hardship in complying with emissions standards relative to non-small refiners. We are in fact finalizing the provisions that were proposed for small refiners, including similar provisions for the treatment of locomotive and marine fuel. Provisions such as these have proved invaluable for many small refiners in the recent implementation of the gasoline sulfur standards, as well as in refiners' planning for the highway diesel standards.

4.4.2 Oppose

What Commenters Said:

Marathon and API commented that we should not allow for the extension of compliance deadlines for small refiners and should promulgate a rule that provides a level playing field upon which all refiners can compete. They stated that allowing small refiners and farm coops to meet the lower sulfur requirements later than other refiners puts the quality of the diesel fuel in the distribution system at risk, threatening the viability and value of lower sulfur products. Postponing compliance dates will also give small refiners the ability to operate and produce substandard fuels longer and at a competitive advantage and will not significantly change the business decisions that those refiners would ultimately make. The commenters believe that the requirement that small refiners take steps to identify and track their noncomplying products is insufficient to address these concerns. In addition, they stated that many refiners that are not qualified as small, are faced with situations similar to those of qualifying small refiners with respect to their older or smaller refineries.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 17-18
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 12

Our Response:

We do not agree with comments suggesting that small refiner flexibility should not be offered. The Agency has identified regulatory flexibility provisions that assist small businesses in complying with new standards while appropriately alleviating the burden that these businesses may face. Small refiners generally face unique circumstances with regard to compliance with environmental programs compared to 'non-small' refiners. Absent specific provisions for small refiners, we would have to consider delaying the overall program until the burden of the program on many small refiners was diminished, which would delay the air quality benefits of the overall program. By providing temporary relief to small refiners, we are in a better position to adopt a program that expeditiously reduces NRLM diesel fuel sulfur levels in a feasible manner for the industry as a whole.

We recognize that while the sulfur levels in the proposed program can be achieved using conventional refining technologies, new technologies are also being developed that may reduce the capital and/or operational costs of sulfur removal. We believe that allowing small refiners some additional time for newer technologies to be proven out by other refiners may have the added benefit of reducing the risks faced by small refiners. Further, this additional time may also increase the availability of engineering and construction resources. Some refiners will need to install additional processing equipment to meet the nonroad diesel sulfur requirements. Vendors will be more likely to contract their services with the larger refiners first, as their projects will offer larger profits for the vendors. Therefore, we anticipate that there may be significant competition for technology services, engineering resources, and construction management and labor. Temporarily delaying compliance for small refiners will allow for overall lower costs of improvements in desulfurization technology and would spread out the demand for construction and engineering resources, and likely reduce any cost premiums caused by limited supply.

In regards to statement that small refiner fuel could possibly threaten the viability of lower sulfur fuels, we recognize the concerns raised about the state of the distribution system, however we believe that any problems that might occur will be readily solvable through such programs as designate and track (see Section IV of the preamble for more information on this program). We do not believe that allowing the presence of high sulfur small refiner fuel in the distribution system imposes a significant additional burden with respect to limiting the sulfur contamination of 15 ppm diesel fuel. Today's rule does not regulate the sulfur content of heating oil (current maximum sulfur content of 2,000 - 5,000 depending on state requirements) or jet fuel (maximum sulfur content of 3,000 ppm per industry standard). Thus, other high sulfur fuels will remain in the fuel distribution system. The highway diesel rule will require 15 ppm highway diesel fuel beginning 2006. Therefore, we expect that the distribution system will be well accustomed to limiting sulfur contamination during the distribution of 15 ppm highway fuel prior to the 2010 implementation date for the 15 ppm NR standard. Small refiner fuel will also not be the only higher sulfur fuel in the distribution system, as the credit provisions and hardship provisions apply broadly to all refiners. Neither do we believe that small refiner fuel will threaten the value of lower sulfur fuels. Small refiner fuel will be of limited value, small refiners already face higher costs, and small refiners often serve isolated markets, which in many cases has allowed them to remain competitive despite higher than average costs.

4.4.3 Small Refiner Definition

What Commenters Said:

Ergon and SIGMA commented that we should revise the definition of small refiner in the proposed rule. EPA has proposed to adopt a small refiner definition that is identical to the onroad rule. EPA should update this definition to reflect Congress' most recent declaration on the most appropriate criteria for classifying refiners as small. The energy tax titles of H.R. 4, the House energy bill, and S.14 (the Senate energy tax bill) all define a small refiner as a company that owns or operates/controls 155,000 barrels per day of crude oil refining capacity and employs fewer than 1,500 employees in its refining operations. The Congressional definition differs from EPA's proposed definition, which does not distinguish between company employees engaged in refining operation and other employees in other parts of the company unrelated to petroleum refining. In developing their definition, Congress has recognized that the most relevant factors in determining size are the crude capacity cap and the number of workers engaged in refining operations. EPA should recognize these factors as well. EPA's definition does not allow for Ergon and other refiners that employ more than 1,500 employees company-wide but own and operate refineries that are very small in terms of crude capacity, to take advantage of important flexibility provisions for small refiners.

Letters:
Ergon, Inc., OAR-2003-0012-0634 p. 3
Society of Independent Gasoline Marketers of America, OAR-2003-0012-0635 p. 5-6
Chicago Public Hearing, A-2001-28, IV-D-06 [Ergon p. 240; SIGMA p. 248]

Crown Central commented that we should ensure that the definition of a small refiner is consistent between all fuel regulations, and that the employment criterion should be eliminated from the proposed rule. Crown believes that this criterion works to the detriment of refiners who have retail outlets, especially those who staff these outlets using employees rather than contractors. Approximately ten personnel are required to staff a typical retail outlet and a refiner owning as few as 150 retail outlets is likely to exceed the employee criteria. The proposed criteria were established to identify refiners who are less able to comply but smaller and less efficient refineries tend to require more personnel per barrel of capacity, and therefore, the employment criterion works against the intended outcome. The employee criterion is difficult to administer and enforce since a significant number of personnel can be engaged through contractors, rather than by direct employment. If EPA decides that this criterion must be included, it should be established at 1,500 employees in the refining segment (excluding retail, chemical, and other segments unrelated to refining).

Letters:
Crown Central Petroleum Corporation, OAR-2003-0012-0640 p. 1-2

ExxonMobil commented that we have unreasonably expanded the purview of the "small" refiners to the current 155,000 BP/CD definition. ExxonMobil believes that refiners of this size simply do not have a sufficient need for help to justify the additional level of complication required, the loss of emission reductions involved, and the increased potential for contamination of ultra-low sulfur diesel. The refiner further stated that the provisions would create a patently unfair situation in the marketplace since these "small" refiners possess a considerable competitive advantage during the period when other refiners must begin trying to recover the cost of their investments to comply with the rule.

Letters:
ExxonMobil, OAR-2003-0012-0616 p. 18

Our Response:

The 155,000 bpcd capacity limit and the 1,500 employee limit were first justified as appropriate limits in the Tier 2 gasoline rule. The criterion of 1,500 employees is an SBA size standard. We will neither be eliminating nor altering the scope of this criterion from the small refiner definition. Further, this limit will enable the rule to remain consistent with previous fuel rulemakings. Also, as with the previous rules, this limit will continue to apply to all employees of a company, not just those involved in refining activities.

When combined with the SBA size standards of having 1,500 employees or less, we continue to believe that the 155,000 bpcd capacity limit is a very reasonable determination of who should be considered a small refiner. Refiners of this size (or smaller) in previous rules have generally needed some sort of regulatory flexibility to meet the standards finalized, and as such, we believe that this is an accurate definition to determine the status of a refiner as small.

4.4.4 Small Refiner Provisions

What Commenters Said:

The compliance option to allow a 20 percent increase in small refiner gasoline sulfur standards should be extended to all small refiners. The proposal provides an adjustment only to the small refiner gasoline sulfur standard established under 40 CFR 80.240(a). There are one or two small refiners for which small refiner gasoline sulfur standards were established through the hardship process of 40 CFR 80.270. These small refiners have had their hardship situation examined and affirmed in a quasi-judicial proceeding and are experiencing as much or more hardship as many other small refiners. Commenter (WFC) provides specific changes to the rule language in this regard.

Letters:
Wyoming Refining Company, OAR-2003-0012-0651 p. 1-2

The requirement for the production of a minimum volume of nonroad diesel unnecessarily restricts small refiners. Proposed Section 80.554(d)(1)(ii) would require a small refiner choosing compliance option #4 to produce 15 ppm nonroad diesel fuel "at a volume that is equal to at least 85 percent of V-NRLM." However, V-NRLM as proposed in Section 80.534(c)(1), is the maximum amount of NRLM diesel fuel a refiner may produce. These provisions require a small refiner choosing this compliance option to produce at least 85 percent of V-NRLM but not more than V-NRLM. This is contrary to the apparent purpose of the proposed rule and restricts small refiners. Mandating a minimum volume of NRLM production, either at 15 ppm or 500 ppm, would conflict with the purpose of maintaining adequate on road 15 ppm volumes. Commenter (WFC) provides revised rule language that could be used to address this issue.

Letters:
Wyoming Refining Company, OAR-2003-0012-0651 p. 2

Our Response:

EPA maintains the authority to consider flexibilities such as those contained in small refiner Option 4 (the NRLM/Gasoline Compliance option being finalized in today's action) as part of a hardship application. However, as with any hardship application, the need for the flexibility would have to be fully justified according to the hardship criteria in the regulations.

4.4.5 Disqualification of Small Refiner Status

What Commenters Said:

EPA should maintain the current definition of small refiner. EPA should maintain the two criteria of 155,000 bpd and less than 1,500 employees in the company. The omission of the 155,000 bpd criterion was obviously an administrative oversight as indicated by EPA. The explanation provided by EPA that both criterion were still in place and required and that the omission was a mistake, has influenced CHS merger negotiations. EPA should maintain the original requirement that the small refinery lose its 'small' status upon merger/acquisition.

Letters:
CHS Inc., OAR-2003-0012-0785 p. 4

A refiner should be disqualified from small refiner status when it exceeds the small refiner criteria. Previous small refiner definitions lacked consistency and were incomplete in definition. A refiner designated as "small" should not be eligible for regulatory relief through EPA's small refiner program, use those savings to help finance large mergers and acquisitions to expand beyond small refiner criterion, and then be eligible for further EPA small refiner relief. From an environmental and competitive perspective, EPA must take action on this matter immediately to maintain the integrity of its small refiner program.

Letters:
Sinclair Oil Corporation, OAR-2003-0012-0704, 0829 p. 4
Tesoro, OAR-2003-0012-0662 p. 2

EPA has not addressed the issue of a refiner (non-small) that is acquired by a "small" refiner, which then loses its small refiner status by doing so. In response to a recent hardship application, EPA extended small refiner options to a former non-small refinery, even though that refinery had previously been required to meet the non-small refinery standards prior to acquisition. Such actions by EPA seem to suggest a disregard for the need for equal treatment and fairness under any small refiner provision. EPA should prevent unjustified extensions of hardship status by including provisions that clearly state that any "small" refiner who loses its small refiner status due to knowingly acquiring a non-small refinery with non-small refinery requirements is ineligible for any type of hardship relief.

Letters:
ExxonMobil, OAR-2003-0012-0616 p. 18-19

Stancil & Co. commented that we should modify the language regarding crude capacity to allow two qualified small refiners that merge together to retain small refiner status even if the merged crude capacity exceeds 155,000 bpcd (and offered suggested language in their comments). Stancil commented that it believes that mergers are a “joining” of company assets and can be done without any money changing hands. Further, mergers are contemplated as a way to improve competitive position and are defensive in nature; they reduce costs by consolidating manpower, knowledge, and corporate overheads. Stancil also stated that mergers do not improve the new entity’s balance sheet or borrowing capability, and future capital spending requirements are not drastically reduced. Stancil further commented that acquisitions are altogether different: one refiner buys another for reasons of enhanced value and growth;

the acquisition is expected to pay out a reasonable return on the purchase price and often be accretive to earnings immediately; and the acquiring refiner considers in the price negotiations the capital spending requirements post completion and makes sure they can fund those requirements while still meeting the payout criteria.

Letters:
Stancil & Co., for Western Refining Company, OAR-2003-0012-0843 p. 1-3

The small refiner status of an entity that expands from internal growth should be able to keep its small refiner status, but not small refiners that grow by acquisition or merger. The proposed rule has the unintended consequence of disqualifying refiners who have grown internally without merger or acquisition. The problem is one of strict interpretation of the language defining the requirements for a small refiner, and the placement of the words "and" and "or." In addition, the proposed rule does not include similar provisions for a continuance of small refiner flexibility for refiners who qualified under the on-road diesel sulfur rule. In fact, the language in the proposed rule is in direct conflict with the language in the preamble. Commenter (Murphy) provides additional discussion on this issue and recommends that EPA clarify their intent in the preamble language, and adjust the rule language accordingly. This commenter provides recommended rule language to address these issues in Attachment 1 to their letter.

Letters:
Murphy Oil, OAR-2003-0012-0212 p. 1-3, Att.1

Our Response:

In the Tier 2 gasoline rule, the 155,000 capacity limit was justified as an appropriate limit for small refiner status. Since then, it has served as one of the two criteria (the other being the 1,500 employee limit) for the definition of a small refiner. However, it was inadvertently left out of the regulations when it came to circumstances that would disqualify a refiner if they grew. The purpose of adding it in today's action is merely to correct that mistake, not to re-define small refiner criteria.

We also do not agree with the idea that a small refiner, that meets the nonroad small refiner definition, but later exceeds the employee limit or the 155,000 bpcd limit due to normal business practices (i.e. not through a merger with a non-small refiner or the acquisition of any size refiner) should automatically lose its small refiner status. We do not intend for the small refiner program to stifle growth through normal business practices, as this is markedly different than a company electing to acquire another company.

We proposed that an approved small refiner that exceeds the 1,500 employee limit or the 155,000 barrel per calendar day crude capacity limit due to merger or acquisition will lose its small refiner status. Our intent has been and continues to be, limiting the small refiner relief provisions to a small subset of refiners that are truly challenged. At the same time, it is also our intent to avoid stifling normal business growth. Therefore, the regulations we are finalizing today will disqualify a refiner from small refiner status when it exceeds the small refiner criteria through its involvement in transactions such as being acquired by or merging with another entity, through the small refiner itself purchasing another entity or assets from another entity, or when it ceases to process crude. However, an approved small refiner which exceeds the employment or crude oil capacity criteria without merger or acquisition, may keep its small refiner status. Furthermore, in the case of a merger of two small refiners, we will allow both entities to retain their small refiner status if they exceed the employee or crude capacity criteria. We agree with commenters that in this situation additional financial resources are not being provided, and as a result the justification for small refiner relief is still valid. The amount of lead time being offered for small refiners that lose their small refiner status through acquisition is discussed below.

In a change from the proposal, we have also allowed for some continued flexibility for those refiners who qualified as small for the Highway diesel rule, but will not qualify under this final rule. We did not intend for the small refiner provisions of the NRLM program to undermine the benefits of other small refiner programs, however we do want to preserve the provisions for small refiner status to those refiners that meet the criteria described in section IV.C. of this preamble. Under the program in the NPRM, refiners that qualify for small refiner status for previous fuels programs but not for the NRLM program would have to produce 500 ppm sulfur NRLM diesel fuel in 2007, 15 ppm sulfur highway and NR diesel fuel in 2010, and 15 ppm LM fuel in 2012. To maintain small refiner flexibility for the highway program (and limit flexibility somewhat for today's program), we are providing refiners facing this situation the flexibility to entirely skip the first step to 500 ppm for NRLM. However, they would be required to comply with the 15 ppm sulfur standards for both the highway and NR programs in 2010 and the LM program in 2012.

4.4.6 Lead time After Acquiring a Small Refinery

What Commenters Said:

CHS Inc. commented that the event that a large refiner acquires a small refiner, EPA should not provide an extension- the EPA proposal to allow an additional 24 months for compliance in cases where a large refiner purchases a small refinery, is unnecessary and may only benefit the large refiner. This could be used as a delay tactic and is inconsistent with the approach taken in the highway rule. Any small refinery that did not originally apply for (and receive) 'small refiner' status should not receive a compliance extension of 24 months.

Letters:
CHS Inc., OAR-2003-0012-0785 p. 4

ExxonMobil commented that the proposed provision to provide "small" refiners that lost their small refiner status due to mergers or acquisitions a minimum of a two year lead time to comply, should be limited to those small refers who merge with other small refiners. In addition, it would be inappropriate to allow such small refiners to generate any credits for "early" production of lower sulfur diesels during this two year lead time. EPA should recognize that mergers and acquisitions are internal business decisions that should not be based on an advantage bestowed by EPA.

Letters:
ExxonMobil, OAR-2003-0012-0616 p. 18

Crown and Valero commented that the proposed time frame of 24 months for a refiner who loses small refiner status to construct desulfurization facilities is reasonable once approval is given. However, the new management of the former small refinery will likely have different perspectives and plans for the facility and should be allowed to review the processes, technology selection, and other project issues, and be given adequate time to merge the required capital expenditure into the capital budgeting and approval process. A transition criterion of 24 months would tend to result in the submittal of a waiver application following almost every small refinery acquisition by a larger entity. Therefore, EPA should establish a transition criterion of 36 months.

Letters:
Crown Central Petroleum Corporation, OAR-2003-0012-0640 p. 2
Valero Energy Corporation, OAR-2003-0012-0628 p. 1-2

Tesoro commented that the two year phase-in period to come into compliance with the standards after losing the small refiner exemption or for a refinery previously owned by a small refiner and sold to a non-small refiner, is appropriate (provided there are provisions to extend this time period as necessary).

Letters:
Tesoro, OAR-2003-0012-0662 p. 2

Our Response:

We agree that some time is necessary for a refiner to come into compliance after losing their small refiner status. The lead time necessary to comply with today's standards could otherwise force the refinery to shut down. As discussed in section IV of the preamble, we agree that 24 months may not be sufficient in many cases. Therefore, in order to provide some certainty, we are finalizing a provision for refiners that acquire a refiner or refinery that, prior to the acquisition, was taking advantage of the small refiner provision to delay compliance. The acquiring refiner would be afforded 30 months of additional lead time to perform any necessary upgrades for the acquired refiner/refinery to meet the non-small standards. We believe that 30 months is both a reasonable and adequate amount of time. This lead time will not be afforded to the acquired refinery in instances where a 'non-small' refinery is acquired. The additional lead time will only apply for an acquired refinery that was previously considered small.

Similarly, in the case of a small refiner that acquires a non-small refinery, that small refiner will be afforded 30 months of additional lead time for its existing refinery to be able to comply with the non-small standards. However, it will not receive any additional lead time for the newly acquired refinery.

Furthermore, since the purpose of this grace period is solely to provide time to bring the refinery into compliance with the NRLM standards, refiners will not be allowed to generate credits for early compliance during this 30 month period. We have also included provisions for a refiner facing instances where the technical characteristics of its planned desulfurization project require additional lead time to apply for additional time.

4.4.7 Small Refiner 'Option 4'

What Commenters Said:

Gary-Williams Energy commented that delayed finalization of the rule could undermine small refiner flexibility. The proposed rule outlines four options for small refiners (80.554). In lieu of Options 1, 2 or 3, a refiner may elect Option 4, which would allow refiners to increase their interim gasoline per gallon average and cap by 20 percent, effective January 1, 2004, if the company produces 15 ppm offroad diesel fuel by June 1, 2006. However, it now appears unlikely that EPA will issue the final rule before January 1, 2004. In fact, final publication may be delayed until sometime much later in the year. As a result, companies like Gary-Williams Energy which elect Option 4 will be significantly disadvantaged. Delay in issuing the nonroad rule and thus the opportunity to apply the interim gasoline flexibility will prevent refiners from taking full advantage of the credits they have earned. If the nonroad rule is issued and effective subsequent to January 1, 2004, EPA should create a provision that would address the disadvantages resulting from delaying the small refiner interim gasoline flexibility of Option 4. Gary-Williams provided additional discussion on this issue including suggested alternatives such as granting temporary relief in order to realize the agency's intent expressed in Option 4 or revising the sulfur caps to adjust for the disadvantage caused by delay.

Letters:
Gary-Williams Energy Corp., OAR-2003-0012-0753 p. 2-3

The ad-hoc coalition of small refiners commented that if the final rule is not issued before January 1, 2004, the effective date for the small refiner interim gasoline flexibility option provision should be made to accommodate the intent of the proposal by granting temporary relief through the Tier 2 gasoline rule hardship provision, increasing the cap and per gallon average and/or extending the applicable time period.

Letters:
Small Refiners Coalition, OAR-2003-0012-0754 p. 2

Countrymark Cooperative commented that EPA should clarify whether a small refiner who has already committed to producing ultra-low sulfur diesel by June 1, 2006 in exchange for an extension of its interim gasoline sulfur standards under 40 CFR 80.553, can elect to exercise the options allowed under 40 CFR 80.554. In addition, 40 CFR 80.554 is not clear as to how many of the first three listed options a small refiner can choose. If a refiner can elect to take any or all of the first three options (in the event that it does not elect to use option 4), it should be clearly stated in the rule. It is important that small refiners be able to use options 1, 2, and 3 in combination with each other.

Letters:
Countrymark Cooperative, OAR-2003-0012-0602 p. 2

Our Response:

We believe, consistent with past interpretations of our rules, that Option 4 can also apply to refiners in hardship situations if they can demonstrate that it is the appropriate relief in a hardship situation, where we determine that one exists pursuant to the hardship criteria. In regard to the refiners commenting that a provision would be needed for small refiners wishing to use Option 4 if the rule is not finalized by January 1, 2004, we have already issued an enforcement discretion which would allow refiners to use this option from January 1, 2004 until this rule becomes effective 60 days from today. Regarding the clarity of the provisions, we have revised the language of these provisions and believe that it satisfactorily addresses the clarity concerns that commenters expressed. These provisions are described in section IV.B of the preamble.

4.4.8 Other

What Commenters Said:

Crown Central commented that refiners who divest, and as a result, meet the criteria for small refiner status should be allowed to apply for a hardship waiver.

Letters:
Crown Central Petroleum Corporation, OAR-2003-0012-0640 p. 2

Countrymark Cooperative commented that EPA should continue to evaluate the impacts of this rulemaking on fuel supplies, particularly in the context of the small refiners' ability to efficiently segregate and move their product. EPA should evaluate on an ongoing basis, the impact of the regulation on refiners, and particularly small refiners. While small refiners make up only a small percentage of the U.S. refining capacity, each plays an important part in the markets it serves, and the loss of any small refiner would be damaging to those markets and to the consumers. Even a small loss in refining capacity can cause supply shortages and price spikes. The U.S. refining capacity is already at a critically low level and any further reductions would result in supply shortages and increased reliance on off-shore refining.

Letters:
Los Angeles Public Hearing, A-2001-28, IV-D-07 [Countrymark p. 100]

Our Response:

Small refiner hardship provisions are for the purpose of allowing refiners that are small an opportunity to comply with the standards without undue hardship. They are not intended to provide a mechanism for other refiners to escape from the standards by selling off assets or reducing employee count. If other refiners are facing hardship, we have provisions to grant flexibility if justified.

We believe that the provisions being finalized today will help alleviate the burdens on small refiners, and enable them to comply with the sulfur standards being set without negatively impacting supply. We will continue to assess supply throughout the implementation of these standards.

4.5 Hardship Provisions

4.5.1 Deadline for Hardship Applications

What Commenters Said:

Crown Central commented that EPA should allow refiners to apply for a hardship waiver at any time prior to the full implementation of the regulation. The proposed rule includes a 2005 deadline for the application of a hardship waiver, even though the rule will not be fully implemented until 2015. In business, conditions can change radically over time and a refiner who encounters difficulties with compliance should be able to seek relief as necessary to assure continued operation.

Letters:
Crown Central Petroleum Corporation, OAR-2003-0012-0640 p. 2

Our Response:

Due to our comprehensive evaluation of both financial and technical information, we are finalizing the requirement that refiners seeking additional time under the hardship provision must apply for relief by June 1, 2005. However, we realize that unusual circumstances could be apparent now or could emerge in the future, therefore we also retain the discretion to consider hardship applications later as well, for good cause.

4.5.2 Notification to States on Potential Hardship Waivers

What Commenters Said:

The New York Department of Environmental Conservation commented that EPA should ensure that there is adequate communication with the States regarding any waivers associated with small refiners or hardship. The proposed rule does not include any process of notification regarding potential waivers that could be granted to industry by EPA. Fuel properties such as sulfur content have impacts on emissions inventories used by states for air quality planning purposes. Any deviations from fuel content regulations that affect fuels consumed can undermine the State planning process. The commenter also noted that even though waivers may be acceptable in some cases, there should be greater communication from EPA regarding these decisions since they impact the quality of fuels consumed in New York and could have an adverse impact on air quality.

Letters:
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 4

Our Response:

We plan to communicate closely with all affected parties, including states, on the fuel provisions.

4.5.3 GPA Refiners

What Commenters Said:

Sinclair commented that EPA should offer incentives to GPA refiners to enhance NRLM diesel fuel sulfur compliance if there is an environmental benefit. Sinclair stated that it believes that the interim gasoline sulfur cap adjustment and the one year extension in the interim gasoline sulfur standards should be maintained. Sinclair further commented that, with respect to the cap adjustment, EPA should apply this incentive to the gasoline sulfur cap (not the 150 ppm sulfur average), meaning the sulfur cap for participating GPA refineries would be no higher than 345 ppm.

Letters:
Sinclair Oil Corporation, OAR-2003-0012-0704, 0829 p. 6-7

Our Response:

We disagree with the statements made by the commenter. The entities that currently receive this relief are in hardship situations (qualified small refiners and refiners with approved hardship relief). The commenter is suggesting that GPA refiners also have an inherent hardship situation, similar to small refiners, which we do not agree with. GPA refiners may, however, apply for hardship relief.

4.6 Technological Issues or Limitations of Meeting the Sulfur Standards

4.6.1 Technical Feasibility of Producing 15 ppm Nonroad, Locomotive, and Marine Fuel

What Commenters Said:

Environmental Defense, NRDC, and STAPPA/ALAPCO commented that the proposed 15 ppm standard is feasible. Desulfurization technology is already available worldwide, and as more active catalysts and new processes to hydrotreat and otherwise reduce sulfur levels are developed and refined, both capital and operating costs should decline. The successful adoption of 10 ppm sulfur diesel in Sweden and Germany demonstrates that ultra-low sulfur diesel fuels can be affordably achieved with current technology. One commenter (STAPPA/ALAPCO) provided additional discussion on the technologies used by refineries to remove sulfur from diesel feedstocks (i.e. hydrotreating) as well as the technologies that are currently being developed, such as more active catalysts. This commenter also noted that many additional changes can improve sulfur removal performance of current distillate hydrotreaters by 40 to 60 percent, such as a reduction in hydrogen sulfide concentrations, an improved vapor-liquid distributor, and an increase in hydrogen purity. An increase in the reactor temperature could also lower sulfur levels but can reduce the lifetime of the catalyst. More extensive changes could include increased reactor volume and addition of a reactor. The commenter concluded that refiners have a variety of technical options for reducing sulfur concentrations down to the necessary levels. Environmental Defense noted that most western refiners will be producing 15 ppm by 2006 and many refiners will be producing significant quantities as early as 2004.

Letters:
Environmental Defense, OAR-2003-0012-0821 p. 16
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 26
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 10-11

API and Marathon commented that production of 15 ppm nonroad diesel is technologically feasible but could result in significant yield losses. Diesel fuels are formulated from various refinery streams, including production from conversion units and virgin feed stocks. Each of the streams contains numerous types of sulfur compounds, which can be simple or immensely difficult to process. There are a number of reliable methods for the production of ultra-low sulfur diesel. The first alternative to be considered is usually reconfiguration (revamps) of existing assets. In situations where a revamp is insufficient, other processing options such as hydrotreating are considered. API provided additional discussion on the possible options that refiners can take to reduce sulfur, and the potential yield losses associated with these options. The commenter asserted that no matter which option a refiner elects to construct, there will be yield losses. In addition, a refiner must further include excess capacity in the unit design to have the capability of reprocessing off-spec diesel. In new units, refinery planners may include an additional 5 percent for downtime and 5 percent or more for off-spec processing. If a refinery does not have the capacity to make up for lost or off-spec production, the additional volume will disappear from the market. EPA must assess the likelihood of significant product yield loss resulting from the application of hydrotreating and other technologies and strategies as well as the overall impact that these losses would have on the supply of diesel fuel.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 18-20
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 18-19

Our Response:

We agree with commenters that the 15 ppm standard is technologically feasible. Refining technology is technically capable of desulfurizing all refinery streams to 15 ppm, although the cost varies among the different streams. Furthermore, we have provided provisions in the final rule that will allow flexibility for distribution and sale of off-spec material, especially that generated in the distribution system without requiring it to be reprocessed. Please see the response to issue 4.6.3.1 for a more detailed discussion and response to the issues of product yield losses and supply.

4.6.2 Permitting

What Commenters Said:

API, ExxonMobil, and Marathon commented that they support the continuation of national and regional permit teams to facilitate permit reviews. The proposed rule will add to the already numerous projects, and thus the construction resources and permits needed, to complete refinery capital improvements. EPA should continue to support and facilitate the permitting of needed refinery and distribution system facility changes that will be required by the rule.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 21
ExxonMobil, OAR-2003-0012-0616 p. 21
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 13

Our Response:

We plan to continue the efforts begun for the Tier 2 gasoline and highway diesel fuel programs, to help states in facilitating the issuance of permits under the NRLM diesel fuel sulfur program whenever such assistance may be needed and requested. We anticipate that such assistance may include both technical and procedural assistance as would be provided by the appropriate EPA Regional and Headquarters offices. To facilitate the processing of permits, we encourage refineries to begin discussions with permitting agencies and to submit permit applications as early as possible.

4.6.3 Impact of Standard on Reliability of Nonroad, Locomotive, and Marine Diesel Fuel Supply

4.6.3.1 Supply Shortages

What Commenters Said:

NPRA commented that the proposed rule is likely to cause supply shortages. The supply and demand balance will most likely tighten in the diesel market due to the highway diesel standards, effective in 2006. High capacity utilization rates at U.S. refineries, growing petroleum product demand for transportation fuels, and the need to address several overlapping fuel standards could stretch supply capabilities to the breaking point. Given these conditions, the likelihood of tight fuel supplies and price volatility becomes much higher, and could be exacerbated by the proposed rule. NPRA also provided data and graphics to support their conclusions on this issue, including information on gasoline, distillates and jet fuel imports, typical refinery production in terms of fuel type produced, highway diesel supply sources, and highway diesel movement within the U.S. Lastly, the commenter cited to examples where supply disruptions have resulted from the implementation of fuel sulfur standards.

Letters:
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 4-7
New York Public Hearing, A-2001-28, IV-D-05 [NPRA p. 86]
Chicago Public Hearing, A-2001-28, IV-D-06 [NPRA p. 22]

API, ExxonMobil, and Marathon commented that EPA has not substantiated its conclusion that the proposed nonroad diesel rule will not adversely affect diesel fuel supplies. EPA examined four cases that could adversely affect the supply of nonroad diesel fuel due to the implementation of the proposed rule. These include blendstock shifts, processing losses, exits from the NRLM diesel fuel market and refinery closure. EPA addressed each of these areas using unsubstantiated arguments and its analysis suffers from a lack of any formal economic or engineering analysis to support its claim of negligible supply impacts. API provided significant additional discussion on each of the four arguments used by EPA in support of its claim that no supply shortages will result, detailing why EPA's analysis in this context is inadequate. API also provided a copy, and detailed discussion and summary of the Baker & O'Brien Study, which shows that supply shortages will occur and that some refiners will close as a result of the proposed rule.

The commenters further stated that EPA cannot reach a conclusion regarding supply without defensible supporting data and analysis. In addition, EPA's supply analysis is not adequately integrated with the potential supply impacts of the impending highway diesel rule, and since it is assumed that there is no tightness in the highway diesel volumes, the cumulative impact of the proposed nonroad diesel rule is not accurately assessed. A recent study by Baker & O'Brien shows that the nonroad diesel rule will exacerbate an already tight diesel market brought about by the impending highway diesel rule. This conclusion is also supported by a recent research report (Fitch Special Report, "What a Smell of Sulfur!" Impact of Low Sulfur Regulations on the U.S. Refining Sector, July 1, 2003) and by the EIA (Energy Information Administration, Department of Energy, Timing of Startups of the Low Sulfur and RFS Programs p. 6, September 2002). In addition to having inadequate data and analysis to support the four cases discussed in the RIA, EPA does not account for the potential strain on the construction and engineering firms that will be used to make the necessary changes to the refineries and has not given sufficient attention to potential operational upsets or downgrades.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 23-32
ExxonMobil, OAR-2003-0012-0616 p. 21
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 19-28

ExxonMobil also commented that the key distribution issue remains how to fit the 500 ppm grade of highway and nonroad diesel in the 2006 to 2010 period into an existing one or two grade distillate distribution system. To the extent that a viable mechanism can be defined that allows for the fungible shipment of highway and nonroad low sulfur diesel during this period, distribution issues will be eased, but not solved entirely. Individual terminals with the capability to manage one or two grades of distillate will need to parse the three-grade structure in such a way that all three grades of fuel are generally available, which will allow for a viable distribution system that can maximize the use of the flexibility provided in the highway and nonroad diesel regulations.

Letters:
ExxonMobil, OAR-2003-0012-0616 p. 20

Our Response:

API raised supply concerns related to the proposal, and comments by others are within the scope of the API comments. API raises two issues related to EPA's projection that there would be an adequate supply of NRLM fuel under the proposed standards. The first objection is that we assumed that there would be an adequate supply of highway diesel fuel (15 and 500 ppm) under the 2007 highway diesel fuel program, which they challenged. The second objection is that the proposed NRLM fuel standards would exacerbate this already tight supply situation. Thus, this analysis will begin with the impact of EPA's 2007 highway diesel fuel program on diesel fuel supply, followed by a further assessment of the impact of the proposed NRLM fuel program on supply. EPA's response applies equally to nonroad, locomotive and marine fuel supply.

Supply Under the 2007 Highway Diesel Fuel Program

API claims that EPA underestimated the supply impacts of the proposed NRLM standards by starting with the assumption that there will be ample supply of diesel fuel after implementation of the 2007 highway diesel fuel program. API cites three studies which project that the 2007 highway diesel fuel program will cause some degree of supply shortfall in the first year or two of the program. These studies were performed by 1) Charles River Associates and Baker and O'Brien (CRA)/BOB),[2] 2) EIA,[3] and 3) Fitch.[4] API did not mention three other studies which addressed the fuel supply impacts of the 2007 highway diesel rule, those performed by 1) Muse-Stancil,[5] 2) National Economic Research Associates (NERA)[6] and 3) Mathpro.[7] These latter three studies identified a number of shortfalls associated with the three studies cited by API and projected little, if any shortfall was likely to occur due to the highway diesel fuel program.[19]

The study by CRA/BOB, which was commissioned by API, assessed refiners' ability to maintain an adequate supply of highway diesel fuel under the 15 ppm cap effective in 2006. As part of this study, CRA/BOB polled a subset of U.S. refiners concerning their plans under a 15 ppm sulfur cap. Using the results of this survey, as well as other information, CRA/BOB projected refiners' costs of meeting the 15 ppm standard, as well as their likely production volumes. CRA/BOB projected that 20 refineries would cease producing highway diesel fuel, reducing national highway diesel fuel production by 12 percent, creating significant shortages and price spikes.

We reviewed the CRA/BOB study in the summary and analysis to the 2007 highway diesel rule. There, we identified a number of weaknesses in the study and rejected its conclusions. In particular, CRA/BOB's conclusions appear to have been strongly affected by their assumptions, as well as the refiner survey they conducted. For example, CRA/BOB assumed that the new sulfur standard would cause 10 percent more highway diesel fuel to be "lost" in the distribution system compared to today (i.e., downgraded to nonroad diesel fuel or heating oil). A much more reasonable estimate would be a total loss of 4.4 percent, as outline in the Final RIA for the highway diesel rule, which represents a 2.2 percent increase over today's estimated losses. Reducing CRA/BOB's incremental loss of 10 percent to 2.2 percent increases the final supply of 15 ppm highway diesel fuel by 9 percent (97.8 percent of refinery production versus 90 percent) compared to that estimated by CRA/BOB. This change alone negates 75 percent of CRA/BOB's projected 12 percent national supply shortfall.

CRA/BOB also concluded that 20 refineries producing highway diesel fuel today would leave the highway diesel fuel market rather than produce 15 ppm fuel and that many other refiners would reduce production. The study did not include sufficient detail to allow a detailed evaluation of CRA/BOB's criteria in selecting these 20 refineries, nor was it possible to determine how much of the shortfall was attributable to this conclusion. Part of their reasoning was that they projected that these refiners faced relatively high costs of producing 15 ppm fuel. CRA/BOB may have also believed that these refiners' financial situation made future capital investment unlikely. However, it does appear that in comparing the compliance costs of various refiners, CRA/BOB did not break the nation into its various fuel markets. Instead, they assumed that every refiner was in direct competition with every other refiner. Also, while CRA/BOB 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 as part of the 2007 highway diesel fuel rule. 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 percent of highway diesel fuel production. Together

[19] There are three additional studies which addressed the costs or supply of highway diesel fuel under more stringent sulfur caps, performed by Argonne National Laboratory for DOE, the National Petroleum Council, and EnSys for DOE. These studies are not discussed here in any detail, as they have been essentially superceded by the studies by Mathpro, EIA and CRA/BOB.

with a more reasonable estimate of downgrades in the distribution system, this would more than compensate for the lost production projected by CRA/BOB.

CRA/BOB also implicitly assumed that the material being removed from the highway diesel market could be sold at a reasonable price in other markets. However, CRA/BOB did not analyze the impact of this additional supply on prices in these other markets, or even if these alternative markets could physically absorb all of this material. Much of the material which CRA/BOB 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 higher boiling portion of straight run or cracked material. It is not clear that such material could be blended into non-highway diesel fuel and CRA/BOB did not analyze this likely problem. Our analyses, supported by a study by Muse, Stancil and Co. (discussed further below), indicate that any substantial quantities of highway diesel fuel diverted to other markets would depress prices in those markets substantially. Thus, CRA/BOB's analysis, which only considered the cost to desulfurize highway diesel fuel, and ignored the loss in revenue of dumping this fuel into other markets must be considered to be seriously flawed in this regard. As pointed out by AAM in their comments to the highway diesel fuel rule, 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/BOB ignored the fact that roughly 15 percent of today's highway diesel fuel is consumed in engines and furnaces not requiring low sulfur 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. Limitations in the fuel distribution system could cause some of these users to continue to burn highway diesel fuel. But, again, any potential shortage in supply would encourage distributors to increase the availability of high sulfur fuel to those able to burn this fuel. CRA/BOB basically assumed that there would be no reduction in the volume of highway diesel fuel consumed in non-highway use.

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.

The EIA and Fitch studies were published after the final highway diesel rule, so they were not evaluated in the summary and analysis of comments to that rule. The EIA study evaluated the likely supply impacts of the highway diesel fuel program using refinery-specific cost projections, similar to CRA/BOB and EPA. EIA used many of the cost inputs developed by EPA in the highway rule, as well as many of their own estimates to project the cost of individual refineries to meet a 15 ppm cap for their highway diesel fuel. In particular, EIA evaluated how these costs might vary if a refiner decreased, increased or maintained their current highway diesel fuel production volume.

EIA projected likely highway diesel fuel supply in 2006 under four assumptions regarding how domestic and overseas refiners would approach new investment in pollution control equipment. EIA also projected demand for highway diesel fuel from domestic refiners under four assumptions regarding the likelihood and level of imports and the use of highway fuel by non-highway diesel engines and furnaces.

Of the four demand scenarios, the most reasonable appears to be Demand B, which includes consideration of the small refiner and temporary compliance options included in the final rule plus assumed imports from refineries in Canada and the Virgin Islands which are generally dedicated to supplying the U.S. market.[20] Under this demand scenario, EIA projected that highway diesel fuel supply would be sufficient in the short run if only a few refiners exited the highway diesel fuel market or a significant number of refiners currently not producing highway diesel fuel entered the market by building new hydrotreaters. Otherwise, if refiners were more cautious in their investment approach, supply would only be adequate if a significant number of non-highway users of highway diesel fuel switched to NRLM fuel or heating oil.

Fitch recently issued a report on the desirability of investing in the common stock of oil industry and oil refining companies. Generally, they foresaw increased profitability in these industries, due in part to their projection that a number of refiners would decide not to invest to meet the upcoming gasoline and diesel fuel sulfur standards and close down. The reduced domestic supply of these fuels would then increase prices and increase the profitability of the remaining refiners.

Being more of a business forecast than a technical analysis, Fitch did not publish any of the details behind their projections. Nor did they present any analysis of the accuracy of their past projections for other markets. We also did not conduct a review of past Fitch projections compared to ensuing events.

NERA conducted a review of the CRA/BOB study, primarily from an economic point of view. NERA focused on the possible price impact of the highway diesel program, as opposed to supply. However, their analysis touched on supply, as well. They found API's price projections (based primarily on the CRA/BOB study) to be "highly pessimistic". Besides being based on an incomplete conceptual framework, NERA found that the CRA/BOB study had made a number of overly pessimistic assumptions:

1) The firm with the highest cost of compliance also had the highest cost of diesel fuel production;
2) That high fuel prices would have no impact on domestic refiners' investment decisions; and,
3) Imported fuel would only be available at the price of the highest cost domestic refiner. NERA projected much lower price impacts than API (CRA/BOB). In doing so, NERA presented a number of potential reasons why the reduction in fuel supply would be less than that projected by CRA/BOB, namely:

1) Those refiners facing desulfurization costs in the top 15 percent of refiners were not price setters in their markets;
2) Imports were available at the 90 percentile of the distribution of cost impacts faced by domestic refiners; and,
3) Moderately higher highway fuel prices would encourage voluntary users of highway fuel to switch to high sulfur diesel fuel or heating oil.

Finally, Mathpro also reviewed the EIA and CRA/BOB studies. One of their criticisms of both studies is that they projected refiners' decisions to invest to meet the highway diesel sulfur cap based solely on their estimated cost per gallon of diesel fuel produced. Mathpro believed that this was overly

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[20] EIA states that imports from these refiners is likely, so Demand A is likely too high. Demands C and D assume large reductions in use of highway fuel for non-highway uses, which may not be feasible without significant investments in the distribution system infrastructure.

simplistic and failed to consider refiners' position in their market, the overall profitability of the refinery, etc. Mathpro made their own cost projections for every domestic refinery. For the refineries facing higher costs, they evaluated whether the refiner served a niche market or faced direct competition from other refineries facing lower costs. They found that roughly two-thirds of the supply reduction projected by CRA/BOB was likely from refineries that would be able to pass their costs on to consumers. Thus, Mathpro projected that these refineries would likely invest to meet the highway diesel fuel standards. Mathpro found a much more limited set of refineries which might be challenged to invest to meet the new highway diesel fuel standards.

Muse, Stancil, in a study performed for EPA, evaluated the alternative markets in which refiners could sell their current highway diesel fuel should they decide not to invest to meet the new standards. They found that domestic refiners located on the Gulf and East coasts (PADDs 1 and 3) could most easily shift their diesel fuel to the high sulfur distillate market or export their fuel with a moderate loss in revenue (e.g., 2-5 cents per gallon). Refineries located outside of these two areas would face much more significant losses (e.g., 15-25 cents per gallon) if the net shift out of the highway diesel fuel market exceeded more than a couple of percent.

The loss of revenue estimated by Muse, Stancil for PADD 2, 4 and 5 refiners far exceeds their likely cost of producing 15 ppm highway diesel fuel. Given that the price of highway diesel fuel is likely to rise to some degree in response to higher refining costs, it is unlikely that these refiners would decide to leave the highway fuel market. This is consistent with the findings of Mathpro, as most of the potential drop in highway diesel fuel production projected by Mathpro was in PADDs 1 and 3. It should be noted that it is easy to import fuel into PADDs 1 and 3. Therefore, should any reduction in highway diesel fuel production occur, there would likely be no logistical constraints associated with replacing this supply with imports.

The above studies apply a variety of approaches and level of detail to analyzing the likely supply of highway diesel fuel under the 2007 highway diesel fuel program. Of all the above studies, EIA appears to have performed the most detailed study, which was facilitated by their access to a considerable amount of refiners' proprietary production data. Some of this data was available to EPA (refiners current production volumes of highway and high sulfur distillate), but some was not (e.g., refinery-specific blendstock volumes). Still, EIA had to make a variety of assumptions regarding refiners' approach to investing in desulfurization equipment, as this cannot be predicted with accuracy, as it depends on yet more refiner-specific information not available to any of the above analysts.

As indicated by the widely varying conclusions resulting from EIA's various demand and supply scenarios, the conclusions of these studies are a strong function of the assumptions made by the authors. If an author has a pessimistic view concerning the potential for refiners to invest in desulfurization equipment, then they are likely to project supply shortfalls. If the author is more optimistic, then they are likely to project adequate supply. The most pessimistic study (CRA/BOB) ignores the downside of not investing: lost revenue and potential oversupply in the alternative market. CRA/BOB also ignores the capability of most of the refiners facing high compliance costs to pass these costs along to consumers due to a lack of local competition or because their competitors face the same relatively high cost. Even Fitch concludes that profits should be good for those refiners who remain in the market. This expectation should actually encourage refiners to stay in the market, because of the expectation that they will be able to pass their costs through to the consumer.

EPA also has an important, additional source of information on future highway fuel supply. As part of the 2007 highway diesel fuel rule, EPA requires refiners to submit projections of their production of their 15 and 500 ppm highway diesel fuel in the 2006-2010 time period. EPA recently published a summary of these pre-compliance reports.[8] Nationwide, in 2006, the first year of the program, the vast majority of refineries currently producing highway diesel fuel project that they will continue to do so. Forty percent projected that they would reduce their production of highway diesel fuel, while 60 percent projected that they would increase production. Eight refineries plan to cease production of highway diesel fuel. However, two of these refineries plan to ship their distillate fuel to other refineries for subsequent processing to produce highway diesel fuel. Thus, highway diesel fuel production will only be lost from six of these eight refineries. Five refineries which currently do not produce any highway diesel fuel plan to do so for the first time in 2006. Overall, refiners' plans indicated that there would be an adequate supply of highway diesel fuel in the 2006-2010 time period.

The refiners' highway pre-compliance reports clearly represent the most accurate projection of future supply of 15 ppm highway diesel fuel available. It is useful to compare refiners' plans from these reports to EIA's and CRA/BOB's expectations regarding refiners' desire to invest in desulfurization capacity. With respect to EIA, it appears that refiners are approaching investment to produce 15 ppm diesel fuel like that assumed in EIA's two more optimistic scenarios. EIA's two other scenarios appear to be overly pessimistic. With respect to CRA/BOB, their projections appear to be much more pessimistic than refiners' actual plans.

Now that we have established that there will an adequate supply of highway diesel fuel, we can move on to the issue of the impact of the NRLM fuel program on diesel fuel supply.

Supply Under the Final NRLM Diesel Fuel Program

In the nonroad NPRM, we presented four ways that refiners might reduce their production of NRLM fuel in response to the proposed sulfur caps: 1) shift a portion of their distillate blendstocks to other markets, 2) loss of distillate fuel during desulfurization (process losses), 3) exit the NRLM fuel market, and 4) close the refinery. API took issue with our analysis of all of these factors. Therefore, we will address each of these areas below.

Blendstock shift: It is well known that there are a wide variety of sulfur-containing compounds in diesel fuel and that some are more difficult to desulfurize than others. The reader is referred to the Chapter 5 of the Final RIA for a more detailed discussion of the chemistry of desulfurization. The most difficult compounds, commonly called sterically hindered compounds, are concentrated in the heaviest portion of the distillate (e.g., that with the highest density and distillation temperature), because the sterically hindered compounds have a relatively high molecular weight. Light cycle oil (LCO) and to a lesser extent light coker gas oil (LCGO), typically contain more of these sterically hindered compounds than straight run distillate or hydrocracked distillate. Thus, refiners could have an incentive to "undercut" their LCO or LCGO and shift the heavier compounds to their residual oil pool. This would be most feasible with regard to LCO if the refiner's FCC unit fractionator (the distillation column at the end of the cracking process unit) was already sufficiently flexible to perform this shift. Refiners could also shift some or all of their LCO and/or LCGO streams to other fuel pools. This would be less efficient (in terms of minimizing the loss of diesel fuel volume per reduction in the concentration of sterically hindered compounds), but could be more easily accomplished, as LCO and LCGO exist as distinct blendstock streams in every refinery.

In the NPRM, EPA concluded that 1) it was technically feasible to hydrotreat LCO down to 15 ppm sulfur and 2) that the revenue lost from shifting LCO volume from diesel fuel to residual fuel would exceed the cost of hydrotreating LCO to 15 ppm. API agreed with the first point, but disagreed with the second point. API did not present any analysis which compared the cost of desulfurizing LCO and other diesel fuel blendstocks. Nor did they provide any comparison of the economics of shifting LCO to other fuel markets versus hydrotreating it. Nonetheless, our own cost methodology outlined in Section 7.2 of the Final RIA quantifies the cost of desulfurizing LCO relative to the other blendstocks. As some current highway diesel fuel refiners indicated in their highway pre-compliance reports that they would reduce their production highway diesel fuel in 2006 to some degree, we decided to estimate the incremental cost of desulfurizing LCO to 15 ppm sulfur. Once this is done, we will roughly estimate how the savings from shifting the heavier portion of LCO and LCGO to other markets might compare.

To assess the savings associated with shifting LCO out of the NRLM pool, we assumed that refineries which had FCC units (where LCO is produced), shifted a volume of LCO equal to10 percent of their total non-highway diesel fuel pool to another market. This volume represents about 30 percent of the total LCO volume. We included the impact of the reduced total volume of distillate fuel treated on the economy of scale of the desulfurization unit, etc. We applied our best estimate assumptions regarding future desulfurization technology, etc., as described in Chapter 7 of the RIA. The results are shown Table 4-1 below.

Table 4-1: Impact of Shifting LCO Out of the NRLM Diesel Fuel Pool

PADD	Base Cost of 15 ppm Nonroad Fuel Cap (c/gal of all 15 ppm fuel produced)	Cost Savings of Reducing LCO (c/gal of LCO removed)
1	5.1	15.2
2	7.8	11.8
3	5.1	9.4
4	11.8	15.6
5	5.7	15.6

As can be seen, the cost savings associated with removing some of the LCO from the nonroad fuel pool are nearly twice the costs of meeting the 15 ppm nonroad fuel cap with all the blendstocks projected to comprise future nonroad diesel fuel. This is not surprising. As shown in Tables 7.2.1-3 (conventional hydrotreating) and 7.2.1-11 (Linde IsoTherming) in the Final RIA, the projected capital costs and hydrogen consumption for LCO exceed those of straight run distillate by a factor of 1.4 and 4, respectively. The costs to treat LCO exceed those of LCGO by a factor of 1.5-2. As the cost to desulfurize LCGO fall in between straight run and LCO, it is reasonable to project that the savings from removing LCGO from the nonroad fuel pool would be roughly halfway between the average desulfurization costs shown above and the savings from removing LCO.

If LCO were removed from the NRLM diesel fuel pool, it would have to be blended into another fuel. Heating oil would be the fuel pool with the next highest value. It is quite possible that some refiners could shift some LCO to heating oil and continue to meet the applicable specifications for this fuel, possibly with some mild hydrotreating. This shift could free up some straight run, hydrocrackate or LCGO distillate to move from heating oil to nonroad diesel fuel, resulting in no net reduction in nonroad diesel fuel supply, but reducing total desulfurization costs. While possible, we have not considered this shift in estimating the cost of the rule, because determining the actual volume of LCO which could be shifted is difficult to assess.

It is also possible that a refiner would shift more volume of LCO to heating oil than that of other blendstocks back to NRLM diesel fuel. (This is only feasible in the Northeast and for Gulf Coast refiners, since the heating oil market after the NRLM rule in other areas of the country will be too small for any on-purpose production of high sulfur distillate, let alone increased volumes.) In this case, the supply of heating oil would increase and the supply of NRLM diesel fuel would decrease. If NRLM fuel prices only rose relative to heating oil by 5-13 cents per gallon, as projected in Section 7.6 of the Final RIA (average total cost case), then a refiner would increase its net profit by saving 10-15 cents per gallon of LCO shifted while losing just 5-13 cents per gallon in terms of the price obtained on the shifted material. However, the NRLM fuel price increase of 5-13 cents per gallon assumes an adequate supply of nonroad diesel fuel. This would only be the case if other refiners compensated for the supply loss due to the LCO shift. The increased supply of heating oil would in fact free up distillate volume at other refineries, particularly those overseas, to move from heating oil to nonroad diesel fuel. If these refiners could produce 15 ppm NRLM fuel for 5-13 cents per gallon, then the price increase would remain at this level. However, it could rise above this level, which is the risk that the refiner planning on shifting LCO out of the NRLM fuel pool would take. Thus, a refiner planning on reducing NRLM fuel production volume has to consider a potential drop in heating oil prices, as well as higher prices for NRLM fuel.

A more extreme move would be to shift the LCO to the residual fuel pool. This is a significant downgrade, but nevertheless represents a floor price that a refiner could expect for his LCO. We compared the relative market prices of highway diesel fuel, heating oil and residual fuel. We did so on a percentage basis, as the cost of crude oil, and thus, the absolute prices of all three fuels varied substantially over this time period. Using spot market prices obtained from EIA, we found that from mid-1994 through the present, heating oil was worth 33 percent more per gallon than residual fuel on the U.S. Gulf Coast. Also, since January 1, 2000, heating oil and highway diesel fuel prices have averaged 73.7 and 75.3 cents per gal, respectively. (These costs were evaluated in absolute terms, as the difference represents the cost of desulfurization, which is less sensitive to crude oil price.) Dividing the 73.7 cent per gallon heating oil price by 1.33 yields a price for residual fuel of 55.3 cents per gallon. The difference between highway diesel fuel and residual fuel price would then be about 20 cents per gallon. We focus on price of highway diesel fuel, as once nonroad fuel meets a 15 ppm cap, it will be indistinguishable from highway diesel fuel.

Thus, shifting LCO to the residual oil market appears to reduce revenue more than hydrotreating the LCO to 15 ppm sulfur. Unless a refiner faced significantly higher than average costs of processing its LCO, there does not seem to be an incentive to shift full-range LCO to the residual fuel market. However, if a refiner could undercut its LCO with its existing FCC fractionator and had a ready market for increased residual fuel volume, it is possible that it could break even or increase profits by shifting some heavy LCO to residual fuel.

The volume of this shift is limited by the demand for residual fuel. As discussed in Section 7.2.1 of the Final RIA for this rule, U.S. refiners have been increasing their hydrocracking and coking capacity faster than they have increased crude oil distillation capacity. These two units convert residual fuel and even heavier material to lighter products having a greater price per gallon. This implies that the market for heavy fuels, such as residual fuel are limited.

Some indication of the extent that refiners believe they can maximize profits by shifting LCO out of the NRLM fuel market can be obtained from refiners' pre-compliance reports for the highway diesel rule. As described earlier in this section, some refiners are planning on either reducing their production of highway diesel fuel or leaving the market entirely. However, others are planning to increase production, either from current levels or by entering the market for the first time. These reports were produced assuming that NRLM diesel fuel would continue as a high sulfur fuel. Therefore, LCO could be shifted to the NRLM market with only a modest sulfur reduction. However, the cetane number of LCO is so poor and costly to increase substantially that refiners are unlikely to have included a substantial shift of LCO to the NRLM fuel pool in their pre-compliance reports for the highway rule. Thus, the absence of a significant drop in highway diesel fuel production with the onset of a 15 ppm cap should indicate that the degree of blendstock shift in the case of NRLM fuel is also likely to be small. Thus, it appears that API's concerns that refiners will shift a large volume of LCO out of the NRLM fuel market are not well founded.

Moving to the issue of undercutting LCO or LCGO (i.e., shifting only the heaviest material to another fuel market), such a shift is difficult to assess quantitatively. It requires detailed knowledge of the concentrations of sulfur compounds in a particular refinery's LCO and LCGO streams, as well as how hydrogen consumption and required reactor residence time varies with various LCO and LCGO distillation endpoints. This knowledge is typically proprietary. Only more general descriptions of the distribution of sulfur compounds in total straight run, LCO and LCGO have been published, and even then without much detail. While most of the studies described above mention this approach to reducing diesel fuel sulfur, none attempt to quantify it. As mentioned above, undercutting LCO and LCGO, if feasible with existing distillation equipment, would be more efficient at reducing sterically hindered compounds. We cannot quantitatively estimate the savings from undercutting LCO. However, depending on how deep the cut, the savings per gallon of heavier LCO shifted could be twice those shown above.

Saving twice the LCO desulfurization costs estimated in Table 4-1 above are clearly significant. However, in this case, the heavy LCO material can only be sold to the residual fuel market. This heavy material is unsuitable for blending into heating oil. As stated above, the size of the residual fuel market is limited and domestic refiners have been making significant investments to convert heavy fuels to gasoline and distillate fuel. The relative savings available to refiners by removing heavy LCO from their 15 ppm diesel fuel pool exists under the highway diesel fuel program, as well as the final today's NRLM fuel program. If this incentive was sufficient to encourage refiners to shift a large volume of heavy LCO to the residual fuel market, it would have been reflected in the refiners' highway pre-compliance reports. Some refiners did project lower production volumes of highway fuel starting in 2006. This could be due to the capability of their existing highway diesel fuel to either produce or be revamped to produce 15 ppm fuel. Or, it could reflect a shift of LCO or heavy LCO to other fuel markets. The fact that such reductions in production were small indicates the limits on such shifts. In fact, any such shifts occurring from the highway fuel program further limit such shifts under this NRLM fuel program. Thus, we do not expect that any shifts of heavy LCO out of the NRLM fuel market will significantly reduce NRLM fuel supply.

Processing Losses: API stated in their comments that hydrotreating NRLM fuel to meet a 15 ppm cap could reduce the volume of NRLM fuel by 2 percent due to cracking of distillate molecules to lighter hydrocarbons. API does not present the source of this estimate. In Chapter 7 of the Draft RIA, we present technology vendor estimates showing a 2 percent reduction in distillate yield upon hydrotreating to 7 ppm. However, this yield loss is in terms of mass, not volume. The yield loss in terms of volume is essentially zero, as density is expected to decrease by 2 percent. This 2 percent loss in distillate mass is converted to naphtha (gasoline blendstock), LPG and refinery gas (ethane, methane). These lighter fuels have both energy and monetary value, the latter being considered in developing overall desulfurization costs. Here, the relevant point is that there is no loss in energy, just a slight shift in its form.

Regarding the supply of diesel fuel, we make the point that these lighter fuels can be used in a refinery and that refiners can adjust their processes to shift other material to the distillate pool, resulting in little net impact in distillate production. API disagrees with this, arguing that refiners currently maximize gasoline production in the summer and distillate production in the winter in order to meet the shifting demands of each product. Thus, API argues, shifts between the two products are not possible.

However, API does not present any information to support their premise that refiners "maximize" production of gasoline in the summer and distillate in the winter. Certainly refiners produce more gasoline in the summer and distillate in the winter. However, it would be a coincidence that the maximum production of each product just matched that of demand. Of the two fuels, it is more likely that gasoline production in the summer is nearer the absolute maximum, since some refiners convert distillate fuel to naphtha in hydrocrackers. However, API presents no evidence that a small fraction of gasoline material could not be shifted to the distillate pool in the winter should additional gasoline material (like that created in a distillate hydrotreater designed to produce 15 ppm fuel) become available. Numerous units in the refinery split hydrocarbons into naphtha (for gasoline production) and No. 2 distillate, such as the atmospheric crude tower and the fractionators which are part of the FCC unit, the coker, and the hydrocracker. Nearly all refineries have an FCC unit and the heaviest portion of FCC naphtha can be easily shifted to the distillate pool. In fact, if refiners are maximizing gasoline production in the summer and additional gasoline blendstock is produced during distillate processing, it should be easy to shift gasoline back to the distillate pool, since refiners were presumably doing all that they could to make their gasoline in the first place.

The absolute maximization of distillate production in the winter is less supportable. Refiners do not convert gasoline blendstocks into distillate. API presents no evidence that additional FCC naphtha could not be shifted to the distillate pool. API does state that refiners' production slates are economically driven. However, API fails to consider the effect of prices on distillate production. Relative prices will encourage refiners to produce the fuel in the greatest demand. If desulfurization to 7 ppm sulfur reduces NRLM fuel production slightly and increases gasoline production slightly, absent other changes, the price of NRLM fuel will increase and the price of gasoline will decrease. This will encourage refiners to shift a small volume of gasoline blendstock to the NRLM pool, exactly as we argued in the Draft RIA. Thus, we continue to project that process losses during desulfurization will not adversely affect NRLM fuel supply.

Leave the NRLM Fuel Market: In the Draft RIA, EPA presented six reasons why we believed that refiners would not leave the NRLM fuel market in order to avoid the costs of producing 15 ppm NRLM fuel.[21] API disputes these arguments, primarily by asserting that they are unsubstantiated and not

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[21]Currently, the NRLM fuel and heating oil markets are usually indistinguishable, as the same physical fuel is sold to both markets. We fully expect that some domestic refiners will continue to produce high sulfur heating oil for the heating oil market. By exiting the NRLM fuel market, we mean that a refiner would decide not to produce NRLM fuel without being confident that he had an established market for its heating oil, or would decide to export his high sulfur

supported by quantitative arguments. These six reasons primarily extend findings made in support of adequate highway diesel fuel supply under the 2007 highway diesel rule to NRLM fuel supply under this NRLM rule. These six arguments are represented below:

1. Approximately one-half of what is currently the U.S. high-sulfur diesel fuel market will have become part of the 500 ppm and 15 ppm markets by the time the 2007 highway diesel rule and the sulfur caps on NRLM fuel have been implemented. Within that same timeframe, we expect few, if any, of the common carrier pipelines, except perhaps those serving the Northeast, will carry high sulfur heating oil. Therefore, the sale of high sulfur distillate may be limited to markets that a refiner can serve by truck.

2. The technology to desulfurize fuel, including refractory feedstocks, to less than 500 ppm sulfur has been used commercially for over a decade. The technology to reduce fuel to less than 15 ppm sulfur will have been commercially demonstrated in mid-2006, a full four years prior to the implementation of the 15 ppm sulfur standard for nonroad diesel fuel.

3. The volume of fuel affected by the 15 ppm nonroad diesel fuel standard in 2010 would be only one-seventh of that affected by the 2007 highway diesel program. This dramatically reduces the required capital investment.

4. Both Europe and Japan are implementing rules to reduce sulfur levels in highway and nonroad diesel fuel to the 10-15 ppm range, which will effectively eliminate these regions as alternative export markets for high sulfur fuel.

5. Refineries outside of the U.S. and Europe are operating at a lower percentage of their capacity than U.S. refineries.[22] Capacity utilization rates at U.S. refineries are well over 90 percent. Historically, if refinery utilization rates approached their maxima, it was usually a strong indication that demand for finished products was high. In this environment, product prices usually rose and held until the demand pressure was reduced or eliminated. Foreign refinery utilization rates as well as wholesale prices tend to be well below domestic rates, again, a reflection of lower demand relative to the potential output of finished products. The preceding condition can have at least two effects on the marketing decisions domestic refiners may face. First, if foreign margins are low and U.S. market prices high, a foreign refiner could, and most likely would, sell his products into the U.S. market, thereby reducing the upward pressure on prices and likely reducing domestic refinery margins. And, second, it is highly unlikely that a domestic refiner would decide to further reduce his margins by adding the cost to ship his product into a foreign market with a less stringent sulfur standard where wholesale prices are already lower than in the U.S. Consequently, we do not believe U.S. refiners will have a reasonable opportunity to export their high sulfur fuel.

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heating oil.

[22] Europe currently imports diesel fuel and is expected to continue to do so. However, European sulfur caps will be equivalent to those in the U.S. Therefore, exporting distillate fuel to Europe is not an option for U.S. refiners to avoid complying with stringent sulfur caps here. Likewise, imports from European refiners are not likely.

6. One measure of the overall fiscal well-being of a refining operation is its margin. Refinery profit margins[23] during the 1990s were not very encouraging until about 1997. In fact, in 1994, the net margin was less than $0.50 per refined barrel. By 1997 it had nearly tripled and by 2000 had increased to nearly five times the 1994 average. Margins leveled out again during 2001 and decreased somewhat during 2002, but recovered during the last few months of 2002 and in early 2003. Current industry projections into the future indicate the expectation for continued high profit margins.

API argues that Muse, Stancil stated that their analysis assumed that the current relative prices existing between various distillate fuels, such as highway diesel fuel and heating oil will continue. This is true. However, API's concern about 15 ppm fuel supplies implies that they believe that the price of 15 ppm fuel will be closer to that of high sulfur heating oil than has been the case in the past. However, API presents no justification for why this would occur. Also, this clearly implies a low price for 15 ppm diesel fuel. Thus, API's premise includes both low prices and short supply. Both can't be true at the same time. It is theoretically possible that refiners could anticipate low prices, leading them to not invest in 15 ppm fuel production capacity and producing a supply shortfall. However, there are at least some industry observers predicting a supply shortfall and, therefore, high prices. This encourages refineries to invest. Also, it supports the premises of the Muse, Stancil study, which indicates that many refiners are likely to see a significant loss in revenue if they do not invest in producing 15 ppm fuel.

In addition, while it is true that EPA did not conduct extensive economic analyses of refiners' economic condition and balance sheet in making the above six points, API did not present any economic or financial analyses of their own to support their challenge of the above findings. As discussed above under the blendstock shift issue, CRA/BOB performed analysis of highway diesel fuel supply for API as part of their comments on the 2007 highway diesel rule. However, this study did not include any of the types of economic analysis, such as the impact of refiners' decisions on fuel prices, refiners' profits under various decision scenarios, etc., which API asserts that EPA failed to perform.

API did submit a new study by BOB in support of their comments to the proposed NRLM rule. In this study, BOB apparently assumed that any refiner with ready access to an export market would export its high sulfur distillate rather than desulfurize to 15 ppm. No support was given for this premise. It is in direct contradiction to refiners' projections in their highway pre-compliance report. It is also in direct contradiction to refiners' responses to every other fuel quality standard which EPA has set since the mid-1980's. Refiners have never responded *en masse* by exporting their fuel production. Yet, based on this premise, BOB projects NRLM fuel shortfalls of roughly 50 percent, at least based on domestic refinery production.[24]

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[23]The terms "margin" or the plural "margins" are often used in the petroleum industry in reference to several different variables including "spread" or "spreads," "net margin" or "cash margin," "gross margin," and "profit margin." The numbers these terms represent are all basically a measure of a revenue minus the cost to produce that revenue, expressed on a per barrel basis of either crude oil or finished product(s).

[24]This shortfall also assumes that 14 refineries will shut down. This assumption is addressed in the next sub-section.

Thus, other than these general disagreements with our six points, API presented no additional arguments supporting their position. Therefore, we continue to project that few refiners will exit the NRLM fuel market as a result of this rule.

Refinery Shutdown: The last of the four ways in which NRLM fuel supply could decrease in response to the NRLM rule would be if domestic refineries decided to cease operations altogether. API presents a number of arguments supporting their premise that the NRLM fuel program will cause several domestic refineries to shut down. One argument is that refineries have been shutting down annually in the U.S. and environmental regulation is a frequently cited cause. They cite two refinery closures where the refiner explicitly cited EPA's low sulfur regulations as the cause of the closures. Two, API presents a study performed by Baker and O'Brien (BOB) which projects a number of refinery closures due to both the 2007 highway diesel rule and a couple of options for NRLM fuel control.

It is true that the number of domestic refineries has been decreasing since the mid-1980's. A number of these refineries had just been reopened in the late-1970's in response to crude oil allocations. Then, in the early 1980's, the combination of higher fuel prices and CAFÉ standards reduced gasoline consumption. When crude oil allocations ceased and the refining industry became subject once again to competitive market forces, a large refining over-capacity existed and a large number of mostly smaller refineries closed over the 5 year period from 1987-1992. During this time, however, total U.S. refining capacity actually increased, as refineries which continued to operate increased capacity. It was not until the late 1990's that refining capacity utilization reached maximum practical levels. While no grass-roots refineries have been constructed in the U.S., total refining capacity has continued to increase through modifications at existing refineries.

A study of the U.S. refining industry performed by the National Petroleum Council (NPC),[9] estimated the capital investment made by refiners in the mid-1990's in response to new environmental regulations. They estimated that this investment represented about half of the total investment made in the refining sector. This study drew a connection between the level of environmentally related investment and the number of refineries closing in the 1990's.

This study also noted the increasing, but still relatively low utilization of refining capacity during the late 1980's and early 1990's. It wasn't until the time of the NPC study that capacity utilization rose to levels which approached the practical maximum. Thus, any refinery closures up to that point did not decrease domestic refining capacity below that needed to fulfill demand. In other words, the refining industry spent roughly 15 years going through a classic rationalization to address chronic over-capacity.

We have clearly entered a new era since 2000. Capacity utilizations are high and imports are increasing. Refinery closures have also slowed. API (and Baker and O'Brien) cites two examples of refineries which have closed since 1999. API does not name the refineries, but they are well known to be the Premcor refineries in Blue Island, IL and Hartford, IL. The Blue Island refinery closed in January, 2001 and the Hartford refinery closed in October, 2002. API states that the owners of these refineries cited EPA's Tier 2 gasoline sulfur standards and the 15 ppm diesel fuel sulfur cap as key reasons that these refineries had to be closed. Premcor did blame these EPA standards on the refinery closures, as can be confirmed on their corporate internet website.

The first thing to note about these two refinery closures is their timing relative to the EPA sulfur standards. The two refineries closed in 2001 and 2002, respectively. The Tier 2 gasoline sulfur standards did not begin to phase in until January 1, 2004 and the highway diesel fuel sulfur cap begins on June 1, 2006. Thus, the EPA sulfur standards could not have possibly been the only reason that these refineries closed when they did. If this were the case, they would have operated until December 31, 2003 and closed just prior to the beginning of the phase in of the Tier 2 gasoline sulfur standards. Thus, the question is why these refineries closed when they did.

We reviewed information presented at the Premcor internet website, as well as information available about environmental activities at these two refineries. There have been a number of incidents at the Blue Island over the past few years. The State of Illinois announced that 23 tons of spent catalyst particles were released on June 16, 2000.[10] Federal and State agencies have also taken a number of enforcement actions against Premcor regarding compliance with local air and water pollution standards at their Blue Island refinery. On August 24, 2000, Premcor announced that they had paid a $2 million fine for illegal wastewater discharges and were investing $70 million to improve process controls at the refinery. On April 1, 2002, Premcor announced that they had reached a settlement with the U.S. Department of Justice, U.S. EPA and the State of Illinois requiring the payment of $6.25 million, again regarding unallowed wastewater discharges. Thus, it appears that Premcor faced significant investments to bring at least one of these two refineries into compliance with local safety and environmental standards. These investments were necessary to allow the continued operation of these refineries in the immediate future. The timing of their closure, therefore, appears to have been due to these other safety and environmental problems and not the EPA sulfur standards.

This understanding is confirmed by the fact that Premcor did not request that EPA grant it relief from either of the two sulfur programs based on hardship. Both the gasoline and diesel fuel sulfur control programs include provisions for obtaining relaxed or delayed standards due to financial hardship.[11] Other refiners have requested and been granted such relief. While the specifics of this relief are confidential, it is reasonable to assume that the relief available to Premcor could have been similar to the delays granted to small refiners. Small refiners were allowed an additional two years to meet the 30 ppm gasoline sulfur standard (2008 instead of 2006) and were also granted relaxed sulfur standards in the interim period (2004-2006). Analogous provisions under the highway diesel fuel sulfur program could have potentially delayed any action to produce 15 ppm highway diesel fuel until 2010. The fact that Premcor did not seek such relief is strong evidence that the primary problems facing the operation of these refineries were of a more near term nature and economically significant.

As mentioned above, Premcor pointed to the EPA sulfur standards as the reasons that these refineries were shut down. It is certainly easier to point to new standards which are outside of management's control than to problems meeting existing safety and local environmental standards, as well as the refineries' specific economic situations, as reasons why these refineries had to be shut down. Also, while the closures in 2000 and 2001 were clearly not due to the EPA sulfur standards, the sulfur standards may still have played some role in the ultimate decisions to close these refineries.

For example, it is likely that compliance with safety and local environmental standards would have required immediate capital investments. Whether Premcor could have raised the necessary funds for these investments is unknown. It is also unknown whether either of these two refineries could have been operated profitably once these investments had been made. However, it is possible that Premcor could have raised the necessary funds and operated these refineries profitably thereafter. If this were the case, Premcor would then have to decide whether future profits could cover both the immediate investments and the fuel sulfur investments. The answer to this last question seems to have been no; future profits would not be sufficient to recover all anticipated investments. Thus, the refineries were closed. What is not clear is the relative contributions of the immediate investments and those related to EPA's fuel sulfur standards. Given the lack of publicly available information on the profitability of these two refineries and the relative investments needed to keep them operating through this decade, it is not possible to determine whether the EPA sulfur standards played a major role in their closure or whether they were a scapegoat for other difficulties. However, the fact that Premcor did not even apply for hardship relief under either of the two sulfur control programs indicates that the *pro forma* profits of these refineries could not have been large even with a delay in the sulfur standards.

In addition, both refineries are located in the Midwest. This area has seen above average refining margins over the past 3 years. This may partly be due to the closure of the two Premcor refineries, so one cannot assume that these refiners would have seen the same refining margins had they stayed open. However, despite the unusually high refining margins of the summer of 2000, Premcor still closed their Hartford refinery in 2001. Thus, it appears that the immediate investments were so substantial as to prevent their recovery in 5-7 years of high margins. It should be noted that Conoco-Phillips has since purchased the Hartford refinery and appears to have integrated at least some of the process units with its adjacent refinery.

To further support their claim that the proposed nonroad rule will close additional refineries, API refers to a study that they sponsored with Baker and O'Brien (BOB). This study examined the refining costs related to both the 2007 highway diesel program, as well as a couple of NRLM fuel control options. These two options were: 1) the one-step fuel program with all NRLM fuel capped at 15 ppm sulfur in 2008 and 2) the two-step fuel program with nonroad fuel capped at 15 ppm in 2010, but locomotive and marine fuel capped at 500 ppm indefinitely. BOB estimated that both rules would cause a substantial number of refineries to close, as indicated in Table 4-2 below.

Table 4-2
Projected Refinery Closures: API Sponsored Study by Baker and O'Brien

	2008		2010	
	No.	Crude Capacity (1000 bbl/day)	No.	Crude Capacity (1000 bbl/day)
Highway Diesel Program	8	504	13	971
Highway plus One-Step NRLM Programs	14	1043	14	1043
Highway plus Two-Step NRLM Programs	12	924	14	1043

There are roughly 125 refineries currently producing diesel fuel in the U.S. (outside of California), with a total crude oil capacity of roughly 16 million bbl/day. As these refineries are operating near full capacity, the closure of 8-14 refineries with a capacity of 0.5-1 million bbl/day would be very significant. The means used by BOB to make these projections should be carefully evaluated.

First, BOB projected future demand for highway and NRLM diesel fuel in the U.S. They stated with EIA's 2000 FOKS report to estimate current diesel fuel consumption. BOB then grew these fuel consumptions using fuel demand growth rates from EIA's 2002 AEO. BOB's future fuel demands are quite consistent with those described in Chapter 7 of the Final RIA for the "EIA" sensitivity case.

Second, BOB projected future growth in domestic, diesel fuel production capacity. They based current production capacity on EIA's PSA report, essentially assuming that domestic refineries were operating at maximum capacity utilization. BOB based future increases in production capacity on increases in crude oil distillation capacity from EIA's 2002 AEO. BOB noted that EIA's AEO 2003 was released during their study and that 2003 AEO projected significantly higher growth in domestic crude oil distillation capacity than AEO 2002 (an additional 700,000 bbl/day by 2008). However, BOB's opinion was that the updated growth rate was too high and they did not update their study accordingly.

BOB's approach of projecting diesel fuel production capacity using growth in projected distillation capacity is consistent with the approach used by EPA in the NPRM. However, BOB's acceptance of EIA's 2002 projection and their rejection of EIA's 2003 projection appears quite subjective, as BOB provides no analysis to support the previous EIA projection.

In AEO 2003, EIA's projected growth in distillate fuel from domestic refineries is larger than the growth in crude oil distillation capacity. This occurs because domestic refineries are expected to augment their crude oil purchases with increased volumes of heavy oil. We have increased our projections of future distillate fuel production in Section 7.2.1.3.3 of the Final RIA to reflect this. Thus, not only does BOB's choice of AEO 2002's growth in crude oil distillation capacity over that of AEO 2003 decrease their projection of domestic diesel fuel production capacity, but it also ignores the impact of heavy oil feedstock on diesel fuel production. Thus, BOB's projections of future domestic distillate fuel production capacity are low in two ways.

The effect of these two differences is large. The difference between crude oil consumption by domestic refiners in AEO 2002 and AEO 2003 amounts to 5 percent just between 2003 and 2008. The effect of adding heavy oil consumption by refiners is roughly the same size. Thus, BOB appears to be underestimating refiners' distillate production capacity in the 2008-2010 timeframe by at least 10 percent. This shortfall occurs prior to BOB's prediction that a number of refineries will close in response to the highway and NRLM fuel programs, while EIA's projections include refinery closures, if any, which they anticipate.

There is one more way in which BOB may have underestimated diesel fuel supply under an NRLM rule. BOB assumes that 5 percent of 15 ppm highway fuel will be downgraded to high sulfur fuel in 2008 and that this will drop to 4 percent in 2010. BOB does not say what they assumed for additional 15 ppm NRLM fuel which would be produced under an NRLM rule. However, if they applied these downgrade levels to 15 ppm NRLM fuel in addition to 15 ppm highway fuel, this would overestimate downgrade and underestimate supply of 15 ppm NRLM fuel. Under the highway fuel program, 15 ppm highway fuel will be widely available across the country. If additional NRLM fuel volume is added to this fuel supply, the number of fuel batches being shipped by pipelines (the major source of downgrade) will not increase. Thus, the absolute level of downgrade should not increase and every incremental barrel of 15 ppm NRLM fuel should basically make it to market. We discuss this in more detail in Section 7.3 of the Final RIA. If true, this would add another 5 percent to the difference between EPA and BOB NRLM fuel supplies prior to the prediction of any refineries exiting the NRLM market or closing.

BOB then estimated the capital cost that each U.S. refinery would likely face in complying with these regulations. BOB projected which refineries would be able to raise the necessary capital and which would be unable to do so. BOB states that they assumed that refineries would defer investment to meet the diesel fuel sulfur caps "whenever they had a reasonable alternative, such as selling heating oil or exporting high sulfur diesel fuel." They "also assumed that some refineries would be unable to raise or justify the capital needed" to produce 15 ppm diesel fuel. They assumed that the other refineries could raise the necessary capital.

Overall, BOB projects that refiners will invest $1.2-1.3 billion to produce 15 ppm NRLM fuel. This is well below the $2.3 billion that we project in Section 7.2.2 of the Final RIA. One reason for the low BOB estimate is that they project that only about half of the required volume of 15 ppm NRLM fuel will be produced. Considering this, BOB's projected capital costs are not much larger than our own. We project an average capital cost of $36 million per refinery. This is well below the $63 million which we project the average refinery will need to invest to produce 15 ppm highway fuel. The highway pre-compliance reports indicate that refiners are planning on making these investments. BOB provides no analysis supporting their finding that refiners of NRLM fuel cannot raise the lower capital investment needed to produce 500 and 15 ppm NRLM fuel.

In predicting refinery closures, BOB states that they considered eight factors:

1) Ownership (large, small, integrated, independent, etc)
2) Product slate (fuels, specialty)
3) Primary market served (niche, competitive, highly competitive)
4) Logistics
5) Local environmental status (attainment, non-attainment)
6) Historical refinery financial performance
7) Competitive threats (imports, new pipelines)
8) Regulatory provisions for small refiners and special geographic areas

These factors are likely to have an impact on any refiner's decision to continue operation or close. However, BOB provides no indication in how they estimated each of these factors, nor how they combined them in order to make a decision. For example, the list refers to historical financial performance. It does not say whether this history goes back 1,5, or 10 years or whether the consistently higher refining margins of the past 2-3 years were considered. Also, the impact of new pipelines are mentioned, presumably as a source of less expensive fuel from distant competitors. For this to be a significant factor, the refineries using this pipeline to supply a new market must have excess production. Otherwise, there would appear to be little reason to expand into a new market, particularly given the high costs of building new pipelines in the U.S. Yet BOB projects significant diesel fuel supply shortfalls in every region of the country except the Gulf Coast. These projected shortfalls far exceed the excess supply in PADD 3. Thus, new pipelines should have very little impact on competition because the fuel to fill the pipeline simply doesn't exist. BOB might have assumed that inexpensive imports would feed these pipelines and fulfill market shortfalls. However, BOB estimated that imports would cost 10-17 cents per gallon, delivered to a U.S. coast. This exceeds the cost of any refinery which we project might make NRLM fuel. Thus, it is unlikely that this fuel is going to be shipped by pipeline and put inland refineries out of business.

Finally, BOB projects that 8 refineries will close by 2008 due to the 2007 highway diesel fuel program, and another 5 refineries by 2010. The first eight refineries were likely projected to shut down at the start of the 15 ppm highway fuel program in mid-2006, as 2008 was the first year which BOB evaluated and the regulatory requirements do not change between 2006 and 2008. This is only 2 years from now. We have no indication that any refineries are planning to close in response to this rule. To the contrary, the highway pre-compliance reports indicate sufficient highway fuel supply in 2006. (It should be noted that BOB did not have access to the summary of these reports at the time of their study.) That 8 refineries would close in 2006 (or 2008) while the temporary compliance option is operative is even more difficult to understand. Up to 20 percent of all highway fuel can be at the 500 ppm level. The highway pre-compliance reports indicate that the vast majority of highway fuel in 2006 is likely to be at 15 ppm. Thus, credits should be both plentiful and inexpensive. That BOB would project so many refineries to close even absent this NRLM rule seems to indicate a strong degree of pessimism about the state of the U.S. refining industry. Given the absence of any solid evidence that 8-13 refineries will be closing in the next two years, we also do not accept BOB's projections for refinery closures related to the NRLM rule.

BOB does not present any financial performance statistics for the refining industry, nor any pro forma analyses of refining profits with and without investment to comply with the two rules in support of their assumptions. The assumption that refiners will defer investment whenever possible seems particularly pessimistic. Given the number of refineries located on ocean coastlines, presumably with access to foreign markets, it is surprising that BOB did not project even more refinery closures with such pessimistic assumptions. BOB, as part of their refining consulting operations, might have access to individual refiners financial condition, including their current profitability and their ability to raise additional capital. However, the extent of this information is not presented. Also, BOB provides no detail about how such information might have been used to make its closure projections. Therefore, we cannot evaluate the potential accuracy of the BOB projections. We have to basically conclude that the projected closures simply represent BOB's opinion and look outside of the study for information which might support or refute the projections.

Another source of information is the status of refiners' plans to comply with the Tier 2 gasoline sulfur standards. The vast majority of refineries which produce diesel fuel also produce gasoline. For these refiners, gasoline is almost always their main product, both in terms of volume and revenue. With the exception of three refineries, all U.S. refineries appear to be on track to comply with the Tier 2 sulfur standards. One refiner, who owns two refineries, has approached EPA for hardship relief with respect to the Tier 2 standards and highway diesel fuel standards. These two refineries have a combined capacity of 160,000 bbl/day of crude oil. EPA has granted this refiner relief which should allow these refineries to continue to be operated. The other refiner, who recently purchased its refinery, approached EPA for hardship relief. In the months following the promulgation of the Tier 2 gasoline and highway diesel sulfur control programs, EPA established a number of alternative compliance plans due to hardship faced by these refineries. These actions also are strong evidence of the options available to refiners in complying with EPA standards. It does not appear that BOB considered these options in developing their projections of refinery closures.

Finally, several refiners, namely some "small" refiners and those serving the Geographic Phase In Area (GPA) have more time to meet the final Tier 2 standards. Thus, their being on schedule is not as significant an indication of a willingness and ability to invest as is the case for other refiners. However, many of these small and GPA refiners have opted to meet the 15 ppm highway diesel fuel cap in 2006 for 100 percent of their highway diesel fuel production starting in 2006, in return for a delay in the applicable Tier 2 gasoline standards. The fact that these refineries are on track to meet the highway diesel fuel standards in 2006 is again a strong indication of both a willingness and ability to invest in meeting both the gasoline and diesel fuel sulfur standards.

Engineering and Construction Resources

We presented a detailed estimated of the level of three types of resources involved in the design and construction of refining equipment in Section 5.7 of the Draft RIA: front-end engineering, detailed engineering, and construction workers. Our methodology follows that developed in an analysis of the U.S. refining industry performed in 2000 by the National Petroleum Council. There, we concluded that the incremental need for these resources would not create a strain on these resources. One reason for this is that both the proposed and final NRLM fuel program does not start until a year after the applicability of the 15 ppm cap on most highway diesel fuel and even longer after the application of the 30 ppm standard on gasoline (excepting small volumes of gasoline granted deadlines after January 1, 2004).

None of the commenters provides any detailed comments or critique of this analysis. Therefore, we have no basis upon which to change our conclusion that the availability of these resources will be adequate.

Operational Upsets and Downgrades

The commenters state that EPA has not given sufficient attention to the effect of potential operational upsets or downgrades on supply. With respect to operational upsets, by delaying implementation of the 15 ppm standard for locomotive and marine diesel fuel until 2012 we have provided two years during which any offspec fuel from any upsets can continue to be sold into this market without reprocessing. Furthermore, we have extended the time over which refiners can use early 15 ppm NRLM fuel credits from mid-2012 until mid-2014. This gives refiners up to four years to sell 500 ppm fuel to the NRLM market and fine tune their processes to minimize the production of material exceeding 15 ppm sulfur. The initial years after highway and nonroad are both required to meet 15 ppm are the years when refiners had the greatest concerns regarding offspec product, and both of these provisions are aimed at addressing this concern. With respect to downgrades, the final rule allows downgraded diesel fuel produced during shipment which meets a 500 ppm cap to be sold indefinitely to the locomotive and marine fuel markets outside of the Northeast/Mid-Atlantic Area. (Inside the Northeast/Mid-Atlantic Area, the heating oil market is very large and refiners should be able to market any downgraded distillate there.) As none of the commenters provided any detailed information, nor any analysis supporting their comments in this area, we consider these comments resolved.

We discussed potentially allowing refiners to sell a small fraction of their production of off-specification 15 ppm diesel fuel into the NRLM market without the use of credits for a limited time with the American Petroleum Institute (API). However, they related that such a provision was unnecessary and would complicate the program. This input confirms our assessment that the provisions included in today's rule that described above will be sufficient to provide an outlet for refinery off-specification 15 ppm diesel fuel.

4.6.3.2 Lead Time to Ensure Supply

What Commenters Said:

API, Exxon, and the New York Department of Environmental Conservation commented that refiners will have adequate time to meet the fuel sulfur standards provided the proposed schedule is not accelerated. Refiners generally need four years to plan for and implement major changes in fuel specifications. Therefore, imposing a deadline earlier than the proposed deadline would not be feasible.

EPA's proposed two-step approach should help to reduce the possibility of additional supply problems. However, noted the New York Department of Environmental Conservation, allowing for any temporary exemptions from the fuel standards would complicate implementation.

Letters:
ExxonMobil, OAR-2003-0012-0616 p. 19
New York Public Hearing, A-2001-28, IV-D-05 [API p. 18]
New York Public Hearing, A-2001-28, IV-D-05 [NY DEC p. 14]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [API p. 42]
Chicago Public Hearing, A-2001-28, IV-D-06 [API p. 90]

Our Response:

We are finalizing the lead time that we proposed for this rule (500 ppm NRLM in 2007, 15 ppm NR in 2010), and are not requiring that LM fuel meet the 15 ppm standard until 2012. We believe that the time frames being finalized today are sufficient for refiners and others throughout the distribution system to plan for desulfurization technologies. Our lead time analysis projects that 27-39 months are typically needed to design and construct a diesel fuel hydrotreater, and 30-39 months are typically needed to design and construct a diesel fuel hydrotreater. The rule will provide refiners and importers 38 months before they will have to begin complying with the 500 ppm cap for NRLM diesel fuel and more than six years before they would have to begin complying with the 15 ppm cap. Therefore, we concur that refiners will have sufficient time to meet the fuel sulfur standards.

4.7 Fuel Lubricity

4.7.1 General

What Commenters Said:

The Alliance commented that we should consider establishing a federally enforceable lubricity standard. A federally enforceable lubricity standard may help maintain the fungibility of the distillate pool. ASTM has adopted the HFRR test method for lubricity, but the standard may not adequately protect advanced LDDVs. EPA should consider adopting the level published in the World Wide Fuel Charter, of 400 microns wear scar diameter @ 60 degrees C HFRR. Those that were against EPA establishing a federally enforceable lubricity standard (API, Marathon, ConocoPhillips, and ExxonMobil) commented that EPA should not set a lubricity standard as part of this rulemaking. Regulatory requirements for lubricity would not make sense at this time, especially considering the ongoing uncertainty and debate regarding what lubricity characteristics may be needed. EPA should maintain its support for the consensus ASTM process for setting an appropriate lubricity specification for highway and nonroad diesel. Progress continues to be made in ASTM on defining an appropriate lubricity test method and setting a corresponding standard. It is anticipated that this work will be completed and implemented prior to the start of the highway or NRLM diesel programs. The ASTM process will allow for agreement on the appropriate specifications.

Further, the New York Department of Environmental Conservation commented that it is not necessary to set lubricity standards as part of this rulemaking. Hydroprocessing to reduce sulfur content and/or aromatics content can reduce diesel fuel lubricity to unacceptable levels, which can be resolved through the use of lubricity improving additives. Although industry has not yet reached a consensus on the optimum test method and test result, these are matters that are best left to the oil refining and diesel engine manufacturing industries and to consensus standards organizations.

The National Biodiesel Board commented that a market-based approach to address lubricity concerns of low sulfur diesel would be the most effective approach.

Letters:
Alliance of Automobile Manufacturers, OAR-2003-0012-0792 p. 3
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 20
Association General Contractors of America, OAR-2003-0012-0791 p. 14
ConocoPhillips, OAR-2003-0012-0777 p. 5
ExxonMobil, OAR-2003-0012-0616 p. 20-21
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 13
National Biodiesel Board, OAR-2003-0012-0776 p. 2
New York Department of Environmental Conservation, OAR-2003-0012-0786 p.4
New York Public Hearing, A-2001-28, IV-D-05 [API p. 21]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [API p. 43]
Chicago Public Hearing, A-2001-28, IV-D-06 [API p. 90]

DoD commented that the proposed approach for the maintenance of fuel lubricity is problematic. EPA has proposed a voluntary approach that would encourage but not require fuel producers and distributors to monitor and provide fuel with adequate lubricity. This approach requests fuel suppliers to voluntarily incur additional costs of monitoring end-user data and to formulate and add a lubricity enhancer to the required fuel. A significant number of suppliers are likely to disregard voluntary guidelines since there is no tangible benefit to compliance and since costs would be lowered through non-compliance. In addition, some suppliers may be reluctant to voluntarily test for lubricity since that would create documentation that could be used in legal actions related to inadequate lubricity. Military users will face an added burden to ensure that both highway and nonroad diesel fuel used in military applications provides sufficient lubricity. Engines used in DoD vehicles and equipment are more vulnerable to lubricity problems than the same engines operated in commercial vehicles and equipment. Commenter (Navy) provides additional discussion on this issue, including examples of problems the military has experienced related to fuel lubricity and recommends that EPA continue to work with industry to adopt lubricity requirements in the diesel fuel standards and finalize a reasonable standard in the absence of industry consensus.

Letters:
Department of Defense, OAR-2003-0012-0617 p. 1-2

EMA commented that ASTM's efforts to incorporate a lubricity specification in D-975 are moving slowly. Therefore, until newer methods prove superior, EMA commented that it believes that we should set a fuel lubricity standard of 3100 g minimum on the SLBOCLE method or, in the alternative, 450 um maximum on the HFRR method at 60 degrees F.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 9

CEMA-CECE and CNH Global commented that fuel lubricity needs to be specified via EN 590 to avoid wear out of the fuel injection system.

Letters:
CEMA-CECE, OAR-2003-0012-0598 p. 3
CNH Global, OAR-2003-0012-0819 p. 3

The National Barley Growers Association commented that EPA should ensure that lubricity is maintained in low sulfur fuels. The sulfur standard may necessitate the replacement or retrofit of existing equipment if lubricity is not adequate, which could be particularly burdensome for the agricultural sector. *[See related discussion under Issue 7.1.]*

Letters:
National Barley Growers Association, OAR-2003-0012-0639 p. 1

AGCA and WBRT commented that it is not necessary to set lubricity standards as part of this rulemaking. Hydroprocessing to reduce sulfur content and/or aromatics content can reduce diesel fuel lubricity to unacceptable levels, which can be resolved through the use of lubricity improving additives. Although industry has not yet reached a consensus on the optimum test method and test result, these are matters that are best left to the oil refining and diesel engine manufacturing industries and to consensus standards organizations.

Letters:
Associated General Contractors of America, OAR-2003-0012-0791 p. 14
Western Business Roundtable, OAR-2003-0012-0636 p. 4

Our Response:

This is an issue first for 15 ppm sulfur highway diesel fuel in 2006, which is what the majority of commenters have focused on. There is still plenty of time between now and when the lubricity standard will be needed for 15 ppm sulfur NR diesel fuel in 2010 and 15 ppm sulfur LM fuel in 2012. EPA first finalized a 15 ppm sulfur diesel fuel standard for highway engines in the 2007 highway rule. In that rule EPA stated that we would rely on industry (ASTM) to set a lubricity standard and we would work with them to do so. EPA has continued to work with industry through ASTM, and we remain hopeful that ASTM will reach a consensus on a standard. If, in fact, EPA does need to promulgate a lubricity standard for 15 ppm sulfur highway diesel fuel, we will also address lubricity for 15 ppm sulfur NRLM diesel fuel in the same rule.

4.7.2 Lubricity Issues

What Commenters Said:

EMA and NMA commented that EPA should continue to evaluate the potential sulfur reduction impacts on fuel lubricity. While most of the fuel property changes resulting from desulfurization have a positive impact on fuel quality, there is the potential for negative effects on fuel lubricity and elastomer compatibility. Lubricity concerns can be mitigated by additization or by blending with higher lubricity components. EMA noted that given the slow pace of the ASTM effort on this issue, EPA should ensure that the effects of fuel sulfur reductions on fuel lubricity and elastomer compatibility are properly accounted for. Also, NMA recommended that EPA conduct additional research including field work on the effects of low sulfur fuels and lubricity before the Tier 4 rule is finalized.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 9, 110
National Mining Association, OAR-2003-0012-0510 p. 2

The National Biodiesel Board commented that the proposed rule indicates that lubricity additives may be needed for light-duty and medium-duty engines that use either low or ultra-low sulfur fuel. EPA should conduct further research, including field work, on the effects of the low sulfur fuels and lubricity before the rule is finalized. Without a complete understanding of this issue, operators may confront significant issues that could impact the ability of their engines to function.

Letters:
National Biodiesel Board, OAR-2003-0012-0776 p. 2

Our Response:

Additives used to increase fuel lubricity properties have been known and available for years. Manufacturers seem to be most concerned with lubricity in common rail systems (most susceptible to wear with low lubricity fuels), which do not exist in current mining applications. With that in mind, if there is adequate lubricity for common rail systems, existing fuel systems (Pump-line-nozzle, EUI, and HEUI) should be adequately protected. The first phase of the CRC DPG lubricity work will confirm this, but all indications from injection system manufacturers in Europe is that they are most concerned with lubricity for common rail systems. The injection systems that are used on mining equipment are similar to those used on-highway and there are no failure issues using current highway 500 ppm S diesel fuel. The CRC DPG is planning on testing these older systems in phase 1 of its test programs at 3 different lubricity levels starting in early 2004. This will confirm whether or not the proposed ASTM specification of 520 micron WSD HFRR is adequate to protect the pumps. If it is not adequate, ASTM will adjust the standard accordingly. If EPA does need to promulgate a diesel fuel lubricity rulemaking for 15 ppm highway diesel fuel, we will also address lubricity for 15 ppm sulfur NRLM diesel fuel at the same time.

The elastomer compatibility issues have been historically linked to the reduction in the aromatic content of diesel fuel. EPA has no plans to significantly reduce aromatic content at this time. In addition, equipment has been redesigned with different materials and replacement parts that have been modified over the last 10 years to resolve the compatibility issues.

4.7.3 Other

What Commenters Said:

The National Biodiesel Board commented that EPA should support the use of biodiesel as a lubricity additive. According to an independent U.S. manufacturer of diesel fuel injection equipment, biodiesel significantly enhances engine lubricity - even at very low blends of one-half to two percent. In fact, blends of one percent biodiesel provide up to a 65 percent increase in lubricity of Number 2 diesel fuel. By incorporating or blending biodiesel with 15 ppm low sulfur diesel fuel, EPA could alleviate lubricity concerns otherwise apparent with low sulfur diesel. No additional labeling requirements related to sulfur content would be necessary when biodiesel is used as an additive to the 500 ppm and 15 ppm fuels because biodiesel is virtually free of sulfur. Because biodiesel is a cleaner, renewable product, whose attributes are consistent with the goals of this proposed rule, EPA should actively support and promote the use of biodiesel as a renewable lubricity additive in ultra-low sulfur diesel fuel.

Letters:
National Biodiesel Board, OAR-2003-0012-0776 p. 2-3

Our Response:

As we indicated in the NPRM, there are indications that low concentrations of biodiesel would be sufficient to raise the lubricity of 15ppm diesel fuel to acceptable levels. Whether biodiesel would be preferable to other available lubricity additives in terms of cost, impacts on sulfur concentration, storage, and other issues, is a matter best left to the market.

4.8 Cetane and Aromatics

4.8.1 General

What Commenters Said:

BP, CHS, ConocoPhillips, and ExxonMobil commented that they support the proposed standards for cetane and aromatics. The commenters further stated that EPA should maintain the proposed NRLM fuel standards that require a minimum cetane index of 40 or an alternative of no more than 35 volume percent aromatics. These standards are consistent with those for onroad diesel fuel. Since storage tanks through the production and distribution system are or will be at a premium, maintaining this consistency will help provide flexibility to distribute both highway and nonroad fuels and consequently, will help mitigate the cost of this proposal. Exxon also stated that these standards, however, should not be applied to locomotive and marine fuels or heating oil since there may be niche markets where these fuels are distributed on a segregated basis.

Letters:
CHS Inc., OAR-2003-0012-0785 p. 3
ConocoPhillips, OAR-2003-0012-0777 p. 5
ExxonMobil, OAR-2003-0012-0616 p. 2, 15
Chicago Public Hearing, A-2001-28, IV-D-06 [BP p. 175]

EMA commented that it is well documented that the processes that remove sulfur in fuel also will result in small but important quality improvements in other fuel properties, and EPA should maintain those improvements by reflecting them in both the certification and in-use fuel specification for nonroad diesel fuel.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 9, 110

One commenter, Flint Hills Resources, did not support the proposed standards for cetane and aromatics. EPA should not implement the cetane index and aromatic requirements in the proposed rule since the impacts are weak or nonexistent for engines to be used in the future. In addition, the vast majority of diesel fuel already meets the EPA cetane index/aromatics specification for highway diesel fuel. There is nothing in the RIA that either demonstrates the benefits or supports such a requirement. EPA should not set a requirement simply because the ASTM standard has a cetane number specification for a particular fuel.

Letters:
Flint Hills Resources, OAR-2003-0012-0667 p. 5-6

Our Response:

We agree with those commenters pointing to the increased distribution efficiency that may be attained through the extension of the highway diesel fuel standards of 40 cetane index or 35 volume percent maximum aromatics to off-highway diesel fuel. We also agree with commenters who point to the fact that compliance with the sulfur standards adopted today is expected to result in a small cetane increase as increases in cetane correlate with decreases in sulfur, leaving little or no further control to meet the standard. This will also be true for fuels used by locomotive and marine engines. Thus we believe that the cetane index and aromatics standards for off-highway fuel will have only a negligible impact on cost.

Setting a cetane index/aromatics standard for NRLM fuel is unrelated to the ASTM standard for cetane number. We agree that the impact of a cetane/aromatics standard on emissions may be small. However, the advantages will far outweigh any cost. As described in section IV of the preamble, the requirement will eliminate the need for refiners and fuel distributors to separately distribute fuels of different cetane/aromatics specifications. Requiring NRLM diesel fuel to meet this cetane index specification thus gives fuel distributors certainty in being able to combine shipments of highway and NRLM diesel fuels. Perhaps more importantly, it can also give engine manufacturers (and end-users) the confidence they need that their fuel will meet the minimum cetane or maximum aromatics standard necessary to maintain minimal acceptable engine performance. Given the inherent difficulty in segregating two otherwise identical fuels were we not to carry over these standards to NRLM, lower cetane NRLM could easily find its way into highway engines. If not designed for this lower cetane fuel, these engines would likely have driveability problems and elevated emission levels. As locomotive and marine diesel fuel and nonroad diesel fuel are expected to be fungibly distributed under the provisions of the final rule, this argument applies equally to all NRLM.

4.8.2 Alternatives to the Proposed Cetane and Aromatics Standards

What Commenters Said:

The Alliance commented that EPA should raise the standards for cetane and/or lower the standard for aromatics. ASTM has not indicated a willingness to address the fuel quality needs associated with cetane and aromatics. EPA should not wait for ASTM to take action on this issue or for additional state regulation beyond California and Texas. EPA should act now to raise the cetane number to 55 and cap total aromatics at 15 percent mass as the next step toward developing clean, nationally fungible, highway and nonroad diesel fuel. As an alternative, EPA could establish standards for cetane at 52 and polynuclear aromatics at 2 percent mass.

Letters:
Alliance of Automobile Manufacturers, OAR-2003-0012-0792 p. 3

Yanmar commented that fuels with a higher cetane number have a greater potential to reduce emissions. The cetane number of the fuel available in the U.S. market is very low as compared to Europe and Japan. Yanmar also provided data that illustrate the benefits of a higher cetane number and recommends that EPA require a minimum cetane number of 45 for nonroad fuel to maximize the effectiveness of the Tier 4 standards.

Letters:
Yanmar, OAR-2003-0012-0615, 0813 p. 8

Yanmar further commented that EPA should use cetane number instead of cetane index. The cetane index does not represent fuel characteristics; and provided an illustration showing the relationship between cetane number and cetane index and asserts that the cetane number is more directly related to emission characteristics.

Letters:
Yanmar, OAR-2003-0012-0615, 0813 p. 8

Our Response:

The primary benefit of extending the highway diesel standards for cetane index/aromatics to NRLM fuel comes from ensuring the fungibility of otherwise identical fuel batches and ensuring a minimum acceptable engine performance. We have not evaluated potential fleet-wide emission reductions that may be possible through more extensive changes to diesel fuel properties, as such changes would be outside the scope of this rulemaking. Should we attempt to address this, we would only do so in the context of a rulemaking addressing the cetane level of all highway diesel fuel as well, in order to maintain fuel fungibility.

We agree that cetane number is a more direct measure of the combustion characteristics of diesel fuel than cetane index. However, because cetane number and cetane index are correlated but not necessarily identical, and in fact are not correlated at all for fuels containing cetane improver additives, a change from cetane index to cetane number could more significantly impact the steps refiners must take to comply. Such a change would also require a concurrent change to the standard applicable to highway diesel fuel in order to maintain the full fungibility of otherwise identical batches of diesel fuel. As a result we do not believe that cetane index should be replaced with cetane number.

4.9 Geographic Coverage

4.9.1 Alaska and Territories

4.9.1.1 Fuel Sulfur Standards in Alaska

4.9.1.1.1 One-Step versus Two-Step Implementation

What Commenters Said:

The State of Alaska and a refiner (ExxonMobil) commented that they support today's action for a two-step implementation of the sulfur standard for NRLM diesel fuel in the urban areas of Alaska.[25] The refiner commented that, combined with not allowing Alaska refiners and importers to participate in the early credits program, a two-step implementation would ensure the availability of low and ultra-low sulfur NRLM diesel fuel for the equipment that may need it. (See issue of early credit program below, as it relates to Alaska.) Another refiner in Alaska, Tesoro, commented that we should implement a one-step approach requiring 15 ppm NRLM diesel fuel starting in 2010. That refiner commented that, due to the limited NRLM market, the benefits of introducing 500 ppm NRLM diesel fuel in 2007 would be minimal. Also, the distribution system in Alaska is not capable of handling another two grades of diesel fuel that would be required between 2007 and 2010, thus 15 ppm fuel would be distributed as NRLM. A third refiner in Alaska, Petro Star, also opposes an interim 500 ppm sulfur standard for NRLM fuel in Alaska and commented that we should require refiners in Alaska to produce 15 ppm fuel only when, and to the extent necessary, that it is needed for changes in engine technology. That refiner indicated that the demand for highway diesel is small in Alaska and 15 ppm highway diesel can be imported with relatively small impacts on the Alaska refining industry, but adding nonroad volumes would greatly increase these impacts. These impacts would fall particularly heavily on Petro Star, as it is the only Alaska refiner that does not produce gasoline.

<u>Letters:</u>
Alaska Department of Environmental Conservation, OAR-2003-0012-0607 p. 1
ExxonMobil, OAR-2003-0012-0616 p. 19
Tesoro, OAR-2003-0012-0662
Petro Star, OAR-2003-0012-0624 p. 2-4

Our Response:

Alaska is currently exempt from the 500 ppm sulfur standard for highway diesel fuel, and we also considered exempting Alaska from the 500 ppm step of the proposed NRLM standards. However, despite the current exemption for highway diesel fuel, officials from the state of Alaska have informed us that some 500 ppm diesel fuel is nevertheless being marketed in many parts of Alaska. Market forces have brought the prices for 500 ppm diesel fuel down such that it is now becoming competitive with higher sulfur, uncontrolled diesel fuel. Assuming this trend continues, requiring NRLM diesel fuel to be produced to 500 ppm beginning June 1, 2007 would not appear to be unduly burdensome. But even if

[25] In its comments, the State indicated it prefers a one-step implementation, but is unclear about whether this comment refers to the entire state or only to the rural areas. In subsequent phone conversations in November and December of 2003, the State confirmed this comment refers only to the rural areas, and that the State prefers the FAHS areas (urban areas) to comply with the nationwide requirements and implementation schedule.

500 ppm diesel fuel were not generally available in Alaska today, as indicated by Petro Star, our expectation is that compliance with the highway program will likely result in the transition of all of the urban area highway diesel fuel distribution system to 15 ppm sulfur beginning in 2006. Urban here means areas accessible by the Federal Highway System.

As Tesoro commented, it could prove very challenging for the distribution system in some of the areas to segregate a 500 ppm sulfur grade of NRLM from a 15 ppm sulfur grade of highway and an uncontrolled grade for other purposes. We believe economics would determine whether the distribution system would handle the new grade of fuel or substitute 15 ppm sulfur diesel fuel for NRLM applications. In the 2007 to 2010 time frame, the NRLM market in some urban areas might be supplied with 500 ppm sulfur diesel, and in other areas might be supplied with 15 ppm sulfur diesel. Thus, requiring 500 ppm diesel fuel (in which 15 ppm diesel fuel could be used as a substitute) for the limited NRLM applications beginning in 2007 does not appear to create any undue burden on the fuel supply or the distribution system in urban Alaska.

Regarding Petro Star's concern about disproportionate impact because it does not produce gasoline, Petro Star is now uniquely eligible for the small refiner flexibilities offered by the highway and NRLM rules. Today's action amends the definition of small refiner to exempt affiliations between a refiner owned and controlled by an Alaska Regional or Village Corporation organized pursuant to the Alaska Native Claims Settlement Act (43 U.S.C. § 1601 et seq.). This amendment applies to both highway and NRLM diesel fuel, and is consistent with the definition of a small business by the Small Business Administration. (See section on small refiner definition, below, for more details.) Consequently, Petro Star is now eligible for small refiner status. If it applies, as it did for highway fuel, and its application meets our requirements and receives our approval, Petro Star would be able to avoid the NRLM sulfur standard of 500 ppm until June 1, 2010, and would be able to avoid the NR/NRLM 15 ppm sulfur standard until June 1, 2014 with an approved compliance plan.

4.9.1.1.2 Credit Trading

What Commenters Said:

ExxonMobil commented that Alaskan refiners and importers should not be allowed to participate in the early credit program, but should supply only low sulfur diesel for NRLM during the 2007-2010 period and ultra-low sulfur diesel after mid-2010 (for both highway and NR). The American Petroleum Institute and another refiner (ConocoPhillips) commented that EPA should allow Alaskan refiners to participate in the early credit program and to be part of the Credit Trading Area (CTA) 5. The American Petroleum Institute stated it would not be effective to disallow refiners and importers from using credits to meet sulfur standards in Alaska, since high sulfur fuel would still be available into the foreseeable future, as would 500 ppm diesel/fuel oil after June 1, 2010. ConocoPhillips stated that we are unfairly treating Alaska by limiting its trading area to the State. It indicated that no refiner in Alaska would be able to obtain credits to make 500 ppm sulfur motor vehicle diesel fuel (i.e. the 80/20 rule) during the period from 2006 to 2010, as there will be no in-state production of 15 ppm diesel for on-highway use. The refiner attributes this projection to the high cost of producing very small volumes of 15 ppm diesel. The refiner also commented we should allow Alaska facilities to use credits generated within their company at other company facilities. This would provide Alaska facilities with increased flexibility but would require investment for 15 ppm production capability at other company facilities.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 18
ConocoPhillips, OAR-2003-0012-0777 p. 7
ExxonMobil, OAR-2003-0012-0616 p. 19

Our Response:

The majority of these comments address concerns with the restriction in the highway rule on credit trading for Alaska. For these reasons, in the proposal we restricted the aggregation of baselines as well under the baseline approach for compliance assurance. For the final rule, we have switched to the designate and track approach. With this change there is no longer any need under the NRLM program for any restriction.

While NRLM credits can be generated and traded nationwide, they are restricted from use in certain parts of the country under the provisions of this final rule. As discussed in the next comment below, and in section IV.D. of today's notice, we are avoiding the burden to terminals of adding marker to heating oil in those areas of the country where demand for heating oil is expected to continue to remain high after today’s final rule. The NRLM diesel fuel sulfur standards will be enforced based in sulfur level in these areas, not through the refinery designation and marker provisions. Consequently, in the area defined in section IV.D of today's notice comprising most of the Northeast and Mid-Atlantic region of the country, as well as in the State of Alaska, most of the fuel program's flexibilities, including refiners' ability to use credits, are not allowed. Refiners and importers may not use credits to offset NRLM diesel fuel with a sulfur content greater than 500 ppm beginning June 1, 2007, or 15 ppm NR beginning June 1, 2010, or 15 ppm LM beginning June 1, 2012, that is produced or imported into the Northeast/Mid-Atlantic Area or the State of Alaska. However, credits generated in these areas can be sold to other refiners and/or importers for use outside these areas.

4.9.1.1.3 Solvent Yellow 124 Marker

What Commenters Said:

The State and refiners commented that Alaska's unique fuel distribution system is not capable of accommodating dye and segregation. The priority of the State and fuel industry is to keep dye out of fuel stream to prevent contamination of Jet-A and to facilitate movement of the fuel. They indicate the transition to low and ultra-low sulfur fuels would be more difficult to accomplish if the fuels have to be dyed and segregated by use. The comments suggest that implementation of refiner product designations, labeling of fuel pumps, retailer education, and rapid transition to ULSD would allow for an approach that does not require the use of dyes or markers.

Letters:
Alaska Department of Environmental Conservation, OAR-2003-0012-0607 p. 2
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 18
Petro Star, OAR-2003-0012-0624 p. 4 (footnote)

Our Response:

Although the fuel marker facilitates the enforcement of the NRLM diesel fuel sulfur standards, for the reasons discussed in today's notice, we decided not to require its use in Alaska. This is consistent with our exemption from the red dye requirement for non-highway diesel fuel in Alaska. As in the Northeast/Mid-Atlantic Area, the NRLM diesel fuel sulfur standards in Alaska will be enforced based on the sulfur level, not through the refinery designation and marker provisions. Consequently, in order to limit the potential sources of fuel not meeting the sulfur standard, constrain the number of end-users who may legitimately have higher sulfur fuel in their NRLM diesel equipment, and thus maintain the overall program's enforceability, we are not finalizing the other provisions that allow for higher sulfur fuel to be produced and/or distributed in Alaska (i.e., credit, refinery gate off-spec allowance, transmix processor, or downstream off-spec fuel). In this regard, Alaska is treated in the same manner as the Northeast. However, credits generated in these areas can be sold to other refiners and/or importers for use outside these areas.

Unlike the situation in the Northeast/Mid-Atlantic Area, we are not prohibiting the production of high sulfur NRLM diesel fuel by small refiners in Alaska. While such a prohibition does not impact small refiners in the Northeast/Mid-Atlantic Area, flexibility for small refiners is expected to be important in Alaska. Thus, we need to preserve the flexibility for high sulfur NRLM diesel fuel in Alaska for small refiners along with eliminating the marker. The program must therefore provide another means of enforcing the NRLM diesel fuel sulfur standards without eliminating a small refiner's ability to produce and distribute high sulfur NRLM diesel fuel.

Under today's program we are finalizing a provision that will allow flexibility for small refiners in Alaska to delay compliance with the NRLM diesel fuel sulfur standards, provided that the refiner first obtains approval from the administrator for a compliance plan. The plan must at a minimum show the following information:

(1) How they will segregate their fuel thru to end-users,
(2) How they will segregate their fuels from other grades and other refiners' fuels, and
(3) All end-users to whom the fuel is sold as well as the fuel volumes.

End-users who receive the fuel must retain records of all fuel shipments to demonstrate that no heating oil was used in NRLM diesel equipment.

4.9.1.1.4 Nonroad Engines Manufactured to Operate on Ultra-low Sulfur Diesel Fuel

What Commenters Said:

The American Petroleum Institute commented that nonroad engines manufactured to operate on ultra-low sulfur diesel fuel should be required throughout Alaska to refuel with diesel fuel meeting the 15 ppm sulfur cap.

<u>Letters:</u>
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 18

Our Response:

Today's action requires all nonroad engines in urban Alaska manufactured to operate on ultra-low sulfur diesel fuel to be fueled with ultra-low sulfur diesel fuel. While we will address in a separate rule the applicability of the sulfur standards as they apply to Alaska's rural areas, prohibitions on the use of high sulfur (greater than 15 ppm) diesel fuel in any engine manufactured to operate on ultra-low sulfur diesel fuel applies to rural areas as well as urban.

4.9.1.2 Provisions for Rural Alaska

4.9.1.2.1 Applicability of Sulfur Standard

What Commenters Said:

The State of Alaska commented that the rural areas should be required to meet the nationwide NRLM requirements, but not until June 2010. The American Petroleum Institute commented that the diesel fuel sulfur requirements should not apply in rural areas of Alaska, as we proposed. Also, ExxonMobil commented that standards should apply for rural and urban areas alike, but that if we do exclude rural Alaska from the standards, it should also be exempt from the parallel vehicle standards.

Letters:
Alaska Department of Environmental Conservation, OAR-2003-0012-0607 p. 1
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 18
ExxonMobil, OAR-2003-0012-0616 p. 19

Our Response:

While these comments are relevant to the proposed rule, we are not finalizing in today's action the fuel sulfur standards and implementation deadlines for NRLM diesel fuel used in the rural areas of Alaska. We will raise this issue in a separate rulemaking, with notice and comment, that will address the requirements for both highway and NRLM diesel fuel in the rural areas.

4.9.1.2.2 Applicability to North Slope Oil Fields

What Commenters Said:

One refiner, ConocoPhillips, commented that we should allow the North Slope oil fields to be classified as rural areas. The refiner based this request on the remoteness of these oil fields, tightly controlled access for security reasons, small number of 2007 model year and later highway diesel vehicles and 2011 model year and later nonroad engines and equipment in the early stages of the highway and NRLM diesel fuel programs, unique production and distribution infrastructure, and the fact that the nationwide cost assumptions are not applicable to these unique facilities. The commenter also suggested that, as a condition of rural designation for these North Slope oilfields, 500 ppm sulfur diesel fuel should be required for highway and nonroad vehicles and engines starting in June 2007, and 15 ppm fuel could be provided on an as-needed basis for the vehicles and engines that need it. This approach would allow market forces to dictate when it is feasible to install new desulfurization units.

Letters:

ConocoPhillips, OAR-2003-0012-0777 p. 6-7

Our Response:

In the proposed rule and today's final rule, we define the areas accessible by the Federal Aid Highway System, "urban areas", as the geographical areas of Alaska designated by the State of Alaska as being accessible by the Federal Aid Highway System. We define the rural areas as all other geographical areas of Alaska. Consistent with this approach being finalized today, we are taking no action on the comment that the North Slope Oil fields should be defined as rural areas and defer that decision to the State of Alaska. Similarly, we are not taking action on the commenters suggested condition of designation, and also defer that decision to the State.

4.9.1.3 Other Modifications to Alaska Provisions

4.9.1.3.1 Small Refiner Definition

What Commenters Said:

One refiner commented that Alaska Native Corporations should be exempt from the employee count requirements of the small refiner exemption, but not the capacity requirements. Refining companies owned by Alaska Native Corporations should be allowed to take advantage of small refiner status even if they do not meet the relevant employee count requirements. The commenter indicated, however, they should be required to have a crude capacity less than 155,000 bpd to qualify for the small refiner exemption, since these corporations might acquire additional refining assets that would cause it to exceed this threshold.

Letters:
Tesoro, OAR-2003-0012-0662 p. 7

Our Response:

Under the Alaska Native Claims Settlement Act (43 U.S.C. 1601-1629), Alaska Native Corporations were formed to administer land and cash assets provided to the Alaska native people when Congress extinguished aboriginal land title in Alaska to facilitate construction of the Trans Alaska Pipeline. Section (e)(2) of the Alaska Native Claims Settlement Act states in part that, "[f]or all purposes of Federal law," direct and indirect subsidiaries of an Alaska Native Corporation are considered to be owned and controlled by natives and a minority and economically disadvantaged business enterprise. This Act makes no distinction among subsidiaries based on number of employees or production capacity.

We proposed, and are finalizing today, a provision that refiners owned and controlled by an Alaska Regional or Village Corporation organized under the Alaska Native Claims Settlement Act are also eligible for small refiner status regardless of number of employees and crude oil capacity. Such an exclusion is consistent with our desire to grant regulatory relief to that part of the industry that is the most challenged with respect to regulatory compliance. It is also consistent with that of the Small Business Administration in its definition of small business. We believe that very few refiners, probably only one, will qualify under this provision.

We note, however, that this affiliation exclusion applies only to affiliations between the refiner and its parent Alaskan Regional or Village Corporation. It does not apply to affiliations between the refiner and additional refining assets the refiner may acquire. Thus, if the parent corporation acquires additional refining assets independent of the original refiner (e.g., a new subsidiary of the parent corporation to be owned and operated independently of the original refiner), the number of employees and crude capacity of those additional assets of the parent corporation would be excluded from those of the original refiner. But if the original refiner acquires the additional refining assets, the number of employees and crude capacity of the additional assets must be considered as part of the original refiner. We believe that this clarification should satisfy the concerns of the commenter.

4.9.2 American Samoa, Guam, Northern Mariana

4.9.2.1 Exclusion from Fuel Sulfur Standards and 2011 Nonroad Emission Standards

What Commenters Said:

The American Petroleum Institute and one refiner commented that the U.S. Pacific island territories should be excluded from the NRLM diesel rule. The refiner commented that such an exclusion is consistent with our prior application of fuel and vehicle standards to these areas and is justified by their unique situation. API commented it supports the exclusion of the U.S. Pacific Territories due to the significant economic burden these regulations would place on those territories and the uncertainties regarding the environmental benefits in these areas. We received no comment adverse to excluding the U.S. Pacific island territories.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 18
ExxonMobil, OAR-2003-0012-0616 p. 19

Our Response:

These comments are consistent with our proposal and today's action.

4.9.2.2 Puerto Rico

What Commenters Said:

The Caribbean Petroleum Corporation commented that the proposed non-road diesel fuel rule would result in a major economic burden for Puerto Rico, and that Puerto Rico should be exempt from the proposed rule.

Letters:
Caribbean Petroleum Corporation, OAR-2003-0012-0646 p. 1

Our Response:

The commenter based its comment on criteria similar to that which we have relied upon for excluding the Pacific island territories from the NRLM (and highway) diesel fuel requirements. However, those criteria do not justify an exclusion for Puerto Rico. For example, the CPC indicated that Puerto Rico lacks internal petroleum supplies and refining capabilities and relies mostly on fuel imports. However, Puerto Rico is close to the U.S. mainland, and to South American and Central American suppliers of fuel to the U.S. mainland, and therefore has ready access to nearby fuel supplies that meet U.S. requirements. In contrast, the Pacific island territories are remote from Hawaii and the U.S. mainland. Most of their petroleum products are imported from East rim nations, from which diesel fuel meeting the new sulfur standard will not necessarily be available.

The commenter indicated that compliance with the 15 ppm sulfur standard for nonroad (and highway) diesel fuel would require separate storage and handling facilities for a unique grade of diesel fuel for nonroad (and highway) purposes. However, in contrast to the Pacific Island territories, Puerto Rico has been subject to the nationwide 500 ppm sulfur standard for highway diesel fuel and associated red dye requirement for non-highway diesel fuel that have been in effect since 1993. Thus, Puerto Rico currently has to provide separate storage and handling facilities for its highway and non-highway diesel fuel. Today's rule will require additional segregation for the NR and LM fuels, but no differently for Puerto Rico than the U.S. mainland and Hawaii. We have no reason to believe that the 15 ppm sulfur standard for highway and nonroad diesel fuel would have a disproportionate impact on the fuel distribution system in Puerto Rico compared to that of the U.S. mainland and Hawaii.

The commenter claims the environmental benefit of the NRLM rule does not justify the cost for Puerto Rico. However, it did not submit any supporting environmental or cost data. We have no reason to believe that the costs of the NRLM diesel fuel program in Puerto Rico will be significantly greater than that of the rest of the U.S. mainland and Hawaii, as discussed above. We also believe that the important air quality benefits of today's action for the 4 million people in Puerto Rico should not be significantly different than those for the rest of the U.S. mainland and Hawaii. Consequently, today's action does not exempt Puerto Rico from the NRLM fuel requirements. Furthermore, the fuel will be needed in Puerto Rico for the engines that will be required there. Exempting Puerto Rico from these standards would result in non-harmonized standards and would result in an isolated market for providing fuel and engines to meet these separate standards.

4.10 Other Fuel Standards Issues

4.10.1 Substantially Similar

What Commenters Said:

The New York Department of Environmental Conservation commented that we should provide an interpretation of the "Substantially Similar" requirements of the Clean Air Act for diesel fuel as was done for gasoline.

Letters:
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 8

Our Response:

Diesel fuel used in nonroad engines is not subject to the "substantially similar" (sub-sim) provisions of Clean Air Act section 211(f). As a result, a formal definition of sub-sim for diesel would not affect nonroad diesel fuel. For highway diesel fuel, the Agency makes a determination of compliance with the sub-sim provisions of the Clean Air Act whenever a new fuel completes the fuel and fuel additive registration process.

4.10.2 Geographic Issues

What Commenters Said:

CARB commented that we should consider adopting higher quality diesel fuel standards as required in the states of Texas and California. They stated that without nationwide standards, interstate traffic (construction, marine, and locomotive) could lead to the consumption of fuel purchased outside of the fuel property control area, which could lead to a reduction in benefits for the area that has adopted the higher quality fuel standards.

Two commenters commented that there are specific geographic issues with respect to the western part of the U.S. that should have been accounted for in the rule. Sinclair commented that, similar to previous fuel rulemakings, we should take into account the unique fuel, environmental, geographic and economic considerations that exist in the western U.S. The refiner stated that there are numerous differences between PADD IV and other areas of the country, including: 1) a minor or nonexistent market for home heating oil; 2) a limited fuel distribution system due to the vast geographic size of the region; 3) self-contained refining and fuel supply dynamics wherein little refined product is imported into, or exported out of the GPA; 4) refiners that are all small (70,000 b/d or less); and 5) a higher level of compliance with NAAQS than the nation at large. Given these differences, Sinclair believes that we should maintain the designation of this area as a geographic phase-in area (GPA) in the final rule, and strongly urges that NRLM credit trading be limited to the region or PADD where the refinery is located. Sinclair is concerned that a company owning a small refinery in PADD IV as well as large refineries in other PADD's could find it most economical to generate NRLM diesel fuel sulfur credits at their large facilities and use them to delay investment at their small PADD IV refinery. In other words, they stated, the high cost of regulatory compliance with PADD IV refineries could lead to a disproportionate use (or dumping) of sulfur credits in area relative to other regions of the country. Sinclair is concerned that this will result in refiners with most or all of their refining assets located in PADD IV (such as Sinclair) being competitively disadvantaged relative to large refiners owning a refinery in PADD IV. The refiner also believes that the intended environmental and visibility benefits of low sulfur NRLM diesel fuel in PADD IV will be delayed longer than other regions. Sinclair believes the more effective solution to this situation is to limit credit generation and use to the PADD where the product is manufactured.

The Oregon Department of Environmental Quality (‘Oregon’) commented that we should reevaluate the effect of the proposed exemptions. Oregon stated that our analysis regarding the effect of the exemptions (i.e. hardship and small refiner exemption)- which indicates that the impact is minor since it potentially only affects about 20 percent of the nation's fuel supply for nonroad engines- ignores the fact that the impact is concentrated in the intermountain western states. In particular, areas like eastern Oregon and Washington are served primarily by refineries allowed until 2014 to fully comply. Oregon believes that individuals seeking to purchase and use nonroad diesel equipment in these areas will be faced with the choice of misfueling, deferring purchase of new equipment, or paying a premium for the low sulfur boutique fuel. Lastly, Oregon commented that our analysis of the exemption also ignores the recent development of voluntary diesel retrofit programs in Oregon and many other states; and that we should reevaluate our analysis on this issue in light of these considerations.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 6
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 8
Oregon Department of Environmental Quality, OAR-2003-0012-0779 p. 1
Sinclair Oil Corporation, OAR-2003-0012-0704, 0829 p. 3-4

Our Response:

Adopting higher quality diesel fuel standards of the sort required by California and Texas might generate additional reductions in regulated pollutants for the current fleet. However, such a fuels program goes beyond the scope of this rulemaking, which is intended primarily to generate emission reductions through the application of new standards for nonroad engines, and to lower the sulfur content of diesel fuel in order to enable the technologies that are expected to be employed to meet those new engine standards. The fact that interstate traffic effects would be reduced under a nationwide clean diesel fuel program is not, in itself, a sufficient reason to implement these types of fuels programs. If we were to adopt higher quality diesel fuels standards, we would need to conduct a thorough assessment of the associated costs, benefits, and cost-effectiveness.

In response to Oregon, we believe that providing special provisions for small refiners are necessary and appropriate for several reasons, which are discussed in section IV.B of the preamble to today's rule. Absent specific provisions for small refiners, we would have to consider delaying the overall program until the burden of the program on many small refiners was diminished, which would further delay the air quality benefits of the overall program. Further, temporarily delaying compliance for small refiners will allow for overall lower costs of improvements in desulfurization technology and would spread out the demand for construction and engineering resources. This will likely reduce any cost premiums caused by limited supply. In response to the misfueling concern regarding small refiner fuel, we believe that any problems that might occur will be readily solvable through such programs as designate and track

In regards to GPA refiners, we are finalizing provisions (small refiner, hardship) to provide flexibility in GPA areas where necessary. However, similar to Puerto Rico, there is no reason to not require the fuel there as well, since engines sold in these areas will need the fuel.

4.10.3 Overall Program Approach

What Commenters Said:

Environmental Defense commented that our approach for monitoring sulfur levels in diesel fuel should meet certain requirements. The commenter further stated that a well designed system should be verifiable, transparent and enforceable both by EPA and the public; maximize environmental and public health benefits; maintain the benefits and program integrity of the highway diesel program; ensure adequate supply; allow highway and nonroad diesel to be distributed through the same pipeline; prevent windfall credits; and discourage dumping of off-specification fuels into the home heating oil or other pools.

Letters:
Environmental Defense, OAR-2003-0012-0821 p. 16

Our Response:

The details of the program that we are finalizing today are discussed above in 4.1 through 4.3 and also in section IV of the preamble; and we believe that the fuel program being finalized today meets the objectives suggested by the commenter.

4.10.4 Use of 500 ppm Sulfur Diesel Fuel Produced from Transmix or Segregated Pipeline Interface in the NRLM Market

What Commenters Said:

US Oil is opposed US Oil is opposed to the extension to 2014 allowing transmix and interface to be sold offroad at a 500 ppm standard. We believe that this will open the door to "games" that will be difficult to monitor and that it will affect our market. There are present capabilities to rerun interface/transmix that allow the normal product specifications to be adhered to.

Letters:
US Oil, 03/30/04, OAR-2003-0012-0917

Our Response:

The designate and track and other record-keeping and reporting provisions under today's rule will ensure that the sale of 500 ppm diesel fuel produced from transmix or segregated pipeline interface into the NRLM market from 2010 though 2014, and the LM market thereafter does not provide the opportunity for additional 500 ppm diesel fuel to inappropriately enter the NRLM market upstream of the terminal. Downstream of the terminal, the fuel marker and Northeast/Mid-Atlantic Area provisions will accomplish this goal. Pipeline operators have a strong financial incentive to limit the amount of 500 ppm sulfur diesel fuel that is generated from pipeline interface since the majority of this product would come from downgraded higher value products such as 15 sulfur diesel fuel and jet fuel. Pipeline operators and other parties in the distribution system also have a strong financial incentive to limit the amount of transmix produced since transmix comes from higher value products and there are substantial costs associated with reprocessing transmix to make it a useable product. Under today's rule, transmix processors will be prohibited from using blendstocks that do not originate from reprocessed transmix to manufacture 500 ppm diesel fuel for sale into the NRLM market from 2010 though 2014, and the LM market thereafter.

Requiring such 500 ppm diesel fuel to be returned to the refinery for desulfurization to meet a 15 ppm sulfur standard would result in a significant additional burden to industry and cost to end-users that we believe is unjustified at this time. In addition, there could be significant logistical constraints to overcome if all such material was to be returned to the refinery for desulfurization, including: the need to for additional storage tanks at terminals and refineries, the need for additional long distance transportation of the material back upstream to a refinery, and concerns about the ability of refiners to accommodate the volume of product that would need to be reprocessed.

5. ENGINE AND EQUIPMENT COSTS

5.1 General Engine and Equipment Cost Issues

5.1.1 Generally Supports EPA's Cost Estimates

What Commenters Said:

MECA commented that the RIA presented a thorough discussion of the costs of DOCs, DPFs and NO_x adsorber technology and the cost estimates are in a reasonable range. MECA also noted generally that costs can vary depending on the engine and the equipment application and that the cost of emission control technologies tend to decrease over time as the volume of product needed increases and the technologies are further optimized to minimize complexity and cost.

Letters:
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 6

The Union of Concerned Scientists noted that their analysis shows that even when one accounts for the system modifications specific to nonroad engines, the overall cost of compliance should be modest, particularly for engines at 75 hp or higher. Installing state-of-the-art pollution controls that reduce emissions by over 90 percent will add only 1 to 3 percent to the base equipment cost of these engines.

Letters:
Los Angeles Public Hearing, A-2001-28, IV-D-07 [UCS p. 67]

CARB commented that cost-effectiveness per pollutant is projected to be even more economical than for the 2007 on-highway rule with PM rated at $8,700/ton and NMHC + NO_x rated at $810/ton. CARB further stated that regardless of the health assessment methodology used, EPA's nonroad proposal is cost-effective.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 11-12

The IBT commented that the estimated cost is reasonable, especially when taking into consideration the potential health benefits.

Letters:
International Brotherhood of Teamsters, OAR-2003-0012-0664 p. 2

Our Response:

We appreciate the commenters' reviews of EPA's cost analyses for this rulemaking. We especially appreciate the review of our methodology and comments from the Manufacturers of Emission Control Association (MECA). MECA and its member companies are in a unique position to predict the cost of the products they will make in the future. Their positive comments on our cost estimates give us additional confidence that our analyses documented in Chapter 6 of the RIA are indeed accurate.

We appreciate the comment pointing out that costs invariably decrease over time. We have attempted to account for this phenomena in our cost estimates by applying a learning curve to our near term cost estimates.

In general, we agree with these comments, but note that the cost-to-price ratios for some equipment, even some >75hp, are estimated to be higher than 1-3% as referenced in the comment from the Union of Concerned Scientists (see Table 6.5-4 of the RIA).

5.1.2 EPA Has Underestimated the Economic Impacts of the Tier 4 Standards on Equipment Costs and Operations

What Commenters Said:

AEM commented that any significant increase in research and development and capital investment burden required to redesign products to adopt Tier 4 controls will have to be apportioned across a relatively low volume of units, since nonroad machines are sold in much fewer numbers than on-highway trucks. EPA's RIA understates the cost increases that will result from the Tier 4 rule. AEM also cited a study completed by Euromot that examined the economic implications of Tier 4, which was aligned with EPA's study on the cost impacts of the 2007 on-highway rule, and indicates that the cost increases will be higher than EPA projects.

Letters:
Association of Equipment Manufacturers (IV-D-403) p. 11-12

The American Rental Association commented that while EPA has provided capital cost estimates, AEM reports results of an analysis by the National Economic Research Associates (NERA) estimating much higher initial costs. NERA found that the cost of nonroad equipment for a Tier 3 standard compared to the current Tier 2 standard might be as much as $12,000 per unit. Implementing the Tier 4 regulation to reduce NO_x by an additional 90 percent is likely to be more expensive. Schneider Trucks, at the recent 2007 Clean Diesel Implementation Workshop, reported that implementation of the regulation for onroad trucks could cost much as $17,000 per unit compared to the EPA estimate of $1,500. In addition, the cost is not equal across all engine sizes. It is likely to cost more to reduce pollution in smaller engines. ARA also noted that a significant percentage of the nonroad rental fleet is small equipment that may be very costly to control and EPA should consider allowing more time for industry to comply to help reduce overall costs. (See additional discussion under issue 3.1.1).

Letters:
American Rental Association (IV-D-493) p. 2-3

The Committee for European Construction Equipment (CECE) and the European Committee of Associations of Manufacturers of Agricultural Machinery (CEMA), in joint written comments, felt special consideration ought to be given for those machines that had to comply with the European noise directive for outdoor machinery (2000/14/EC) with a stage 2 taking effect in 2006.

Letters:
CEMA-CECE, OAR-2003-0012-0598 p. 3

Our Response:

With respect to the comment from ARA which references an AEM report which, in turn, references a NERA cost estimate for the Tier 3 standard that predicts cost increases that might be as much as an additional $12,000 per unit, we have dealt with this comment and the referenced study within the context of the Tier2/3 rule. We responded then that many of the costs estimated in the NERA study could not be substantiated.[12] We also argued that, because of the concerns with the NERA report, we were not prepared to rely on its predicted cost estimates.[13] Furthermore, we have not reassessed, reconsidered, or otherwise reopened the Tier 2/3 rule, so this comment is not relevant to this proceeding.

As for the ARA comment that references the Schneider Truck estimate of $17,000 per unit, we were unable to find that number in the Schneider presentation made at the 2007 Clean Diesel Implementation Workshop.[14] In this presentation, a price increase associated with the 2007 standards is shown as $16,000. However, while this is an estimated price increase rather than an estimated cost increase, as we have estimated, there is no documentation in the presentation that sheds light on the basis for the estimate. This contrasts sharply with the extensive documentation of engine and equipment costs that we have made in Chapter 6 of the RIA. Also, comments from the Manufacturers of Emission Control Association with respect to our aftertreatment cost estimates suggest that our estimates are reasonable.

ARA also commented that it would cost more to reduce pollution on smaller engines. The basis for this comment is not clear. Since costs of exhaust emission control devices will be directly proportional to the size of the device which, in turn, is directly proportional to the size of the engine, there is little chance that costs for smaller engines will be higher than for larger engines. If this was the commenter's point, then we disagree. If the point of the comment was that, on the basis of a percentage of the engine/equipment price, the costs for smaller engines will be greater, we neither agree nor disagree because it depends more on the type of equipment than on the size of the equipment. We acknowledge this fact in tables showing our cost estimates as a percentage of engine/equipment price (see Table 6.5-4 of the RIA). Our sales weighted cost estimates for engines <75hp range from ~$100 to ~$700, and for larger engines it ranges from ~$1,000 to $7,000 per piece of equipment (see Table 6.5-2 of the RIA). This cost increase equates to an estimated increase of 1-3% relative to the new equipment price for some types of equipment (e.g., construction, industrial, some agricultural) regardless of size, and 5-10% for other types of equipment (e.g., gensets, pumps) more or less regardless of size. The point here is that, for equipment consisting of an engine with substantial value added engineering (an agricultural tractor, a dozer), the cost-to-price ratio is low since the cost of the engine is a small proportion of the cost to produce the piece of equipment. For equipment consisting of little more than an engine and some basic sheet metal (i.e., a genset, a pump, a compressor), the cost-to-price ratio is relatively high since the cost of the engine constitutes a high percentage of the cost to produce the piece of equipment. None of this suggests that the cost of controlling pollution on small engines or equipment is higher than on larger ones.

The commenter further suggests that EPA allow for more time for smaller engines to comply given how costly the new standards will be. We do not believe that the costs estimated for the 2008 standards can be considered to be very costly (~$150 to ~$250 per machine, see Tables 6.4-7 through 6.4-10 of the RIA) and, for those standards that are more costly due to the addition of a CDPF and associated hardware, the smaller engines have until the 2012/2013 timeframe to comply. This represents eight to nine years prior to compliance, and five to six years additional time beyond the date when on-highway diesel engines must meet a similar standard.

Regarding the AEM comment and the Euromot study, AEM did not specify the report from Euromot to which they were referring, and they did not provide EPA with a copy of the report. We did receive a study from Euromot and the Engine Manufacturers Association during the development of the proposal titled "Investigations into the Feasibility of PM Filters for Nonroad Mobile Machinery." This report is available in the public docket for this rule, Air Docket A-2001-28, item number II-B-12. We assume this is the report the AEM is referencing. AEM's comments state that *"Euromot did a good study on the economic implications of Tier 4, which aligned with EPA's study on the cost implications of the 2007 on-highway rule that deals with the introduction of similar emission control technology. Comparing the findings of these two reports indicates there is a greater cost increase than what EPA projected for the nonroad equipment cost increase in the proposal."* Assuming the joint Euromot-EMA report is the referenced document, we disagree with this comment. The report from Euromot focuses primarily on the feasibility of applying particulate filters to nonroad diesel engines and equipment. The Euromot-EMA report is 41 pages long, and it contains 1 page plus 1 paragraph discussion on cost. The following is a summary of some of our concerns with using any of the cost information contained in the Euromot-EMA report in EPA's cost analysis:

- the terms "price" and "cost" are used interchangeably.
- there are no references for the information which is presented, but for PM filter cost estimates uses the phrase "Costs roughly estimated".
- the specific type of PM filter technology is not discussed (CDPFs or burner-assisted filters)
- PM filter precious metal loadings are not specified or discussed
- PM filter regeneration methods are not specified or discussed
- PM filter substrate material is not specified or discussed
- PM filter dimensions are not specified or discussed

EPA's engine cost analysis in the RIA for this final rule is more than 90 pages long, and contains more than a dozen technical references. All of the items identified above as concerns with the Euromot-EMA report are fully documented in EPA's cost estimate. With no documentation regarding what the basis for the cost estimates are, or even a basis for determining what costs are being estimated, we disagree with the commenter that this report is a useful comparison to EPA's Tier 4 estimates, or that this report provides a basis to claim that EPA has underestimated the costs of Tier 4. Contrary to what the commenter suggests, the Euromot-EMA report does not discuss the costs of the highway 2007 rule, so it is not clear what relevance this comment has to the Tier 4 rule. Also, the Euromot-EMA report does not estimate the costs, or include any discussion of, NOx control technology for nonroad diesel engines. Finally, we should note that the above comments are not intended to be a criticism of the joint EMA-Euromot report as a whole. The EMA-Euromot report, which mostly discusses technical issues, does in fact contain a good discussion of PM filter technologies and the technical challenges of applying PM filters to nonroad diesel engines.

The Committee for European Construction Equipment (CECE) and the European Committee of Associations of Manufacturers of Agricultural Machinery (CEMA), in joint written comments expressed concern about the impact of the Agency's emissions regulations in the context of European noise requirements. Given the alignment of emissions standards in Europe and the United States, it seems clear that the European Commission feels the emissions targets may be met when coupled with the noise requirements. There are no plans to provide special provision s for nonroad diesel engine or equipment manufacturers that sell in both markets as those that sell in the European market will clearly not need special provisions in the United States to meet the same emissions standards in the context of the European noise requirements.

5.1.3 EPA Should Use Today's Equipment Cost as the Baseline of Comparison and Not a Tier 3 Level Machine

What Commenters Said:

AEM commented that the economic impact analysis in the RIA is potentially misleading to the user groups who make the purchase decision to buy new equipment. The typical new equipment purchaser will experience the sticker shock from today's price of equipment (Tier 1 and 2) to that of Tier 4. Therefore, a better gauge of the economic impact on the end user would be to use today's equipment cost as the baseline of comparison and not a Tier 3 level machine.

Letters:
Association of Equipment Manufacturers, OAR-2003-0012-0669, 0670 p. 13

Our Response:

We believe that what the commenter means to say is that we should use today's engines, not Tier 3 engines, as the baseline for developing costs. We strongly disagree. We have already estimated costs associated with the Tier2/3 rule and have accounted for those costs in the context of that rule. Not including those costs (and the associated technology packages) in our Tier 4 baseline would amount to double counting. Nor is this a mere accounting exercise. We included those costs in the Tier2/3 rule because we estimated that the costs reflected the technological means by which engine and equipment manufacturers would comply with those rules. As discussed in the RIA and preamble to this Tier 4 rule, recent 2004 MY certification data supports the accuracy of our technological assessments for engines under 100 hp (a focus of the comments of a number of equipment manufacturers in this rulemaking).[26]

However, if the commenter means to suggest that we use Tier2/3 equipment prices as the baseline for our cost-to-price ratios, then we agree that Tier 3 would probably provide a better baseline for comparison than today's equipment prices which we have used in our Economic Impact Analysis (EIA) contained in Chapter 10 of the RIA. Presumably, the prices for future equipment (i.e., Tier2/3) will be higher than today's equipment which would, in turn, make our cost-to-price ratios lower. In this sense, our Economic Impact Analysis is conservative as it is based on the impact of the Tier 4 program on Tier 1 and Tier 2 equipment prices. Thus, that analysis overestimates the percent increase in cost (i.e., we get the numerator correct, but the denominator based on Tier 1 and Tier 2 prices is too small) and therefore overestimates the market impacts of the Tier 4 program.

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[26] Note that it also bears mention that the commenter did not suggest that EPA calculate emissions reductions from present levels (i.e., ignoring any reductions attributable to the Tier2/3 rule), yet that would be the logical corollary to what is suggested by the comment.

5.1.4 The Nonroad Sector Has Far less Ability to Absorb the Costs of Developing New Engine Configurations and Redesigning Equipment

What Commenters Said:

Ingersoll Rand commented that, unlike on-road engines, many engine models designed for nonroad equipment are produced in very low volume, which increases the cost of compliance for manufacturers. In fact, because of the cost pressures exerted during implementation of EPA's Tier 1 and 2 standards, engine manufacturers have discontinued their offering, without subsequent substitution, of several small-volume nonroad engine models. In addition, there is a very limited number of engine manufacturers with no U.S. manufacturers of diesel engines below 40 hp. If a single engine manufacturer decides to discontinue a certain engine family, the effect is felt throughout a broad range of equipment manufacturers that use the engine in a variety of applications.

The Committee for European Construction Equipment (CECE) and the European Committee of Associations of Manufacturers of Agricultural Machinery (CEMA), in joint written comments stated that their customer base is comprised of largely small entities such as small farms and contractors. Their sensitivity to price increases created the potential for pre-buy and post-buy concerns.

Letters:
Ingersoll-Rand, OAR-2003-0012-0504 p. 8
CEMA-CECE, OAR-2003-0012-0598 p. 3

Our Response:

We believe that, if there is a market for a particular engine, engine manufacturers will produce and sell that engine. The NRT4 rule should have no impact on that basic open market tenet. Manufacturers that discontinue engine lines do so for many reasons, and the commenter provided no data to substantiate their claim that the Tier 1 or 2 standards resulted in the elimination of engine product offerings in the U.S. The 2004 public engine certification database shows that, in 2004, there are over 40 nonroad engine manufacturers (see www.epa.gov/otaq/certdata.htm). The database also shows that over 15 of those engine manufacturers make engines in the <40hp range. We do not disagree that an engine with very low sales might be discontinued if a manufacturer can no longer justify the incremental cost for maintaining the product line (e.g., research and development costs to improve their product). As described in our response to comment 5.3.1.4, we do not believe that many if any engines in this power category are truly produced in small volumes. However, we believe that, for every engine line discontinued by a high-cost manufacturer, provided there is a demand for that engine line or one with similar characteristics, there will be a new engine line developed by a lower-cost manufacturer with greater ability to meet customer needs. Further, we believe that it is highly unlikely that an equipment manufacturer will be unable to find an engine with the operating characteristics they demand—that engine may come from a different manufacturer than it does today, but it likely will be provided by a manufacturer with greater ability to adapt to changes in the market by controlling costs and satisfying their customers.

CEMA-CECE provided no data indicating cost or price elasticities. The commenter also provided only an anecdotal assessment of potential outcomes without addressing actual expected cost increases.

5.2 Methodology for Estimating Engine and Equipment Costs

What Commenters Said:

The Mercatus Center commented that EPA's regulatory cost accounting explicitly rejects basing cost estimates on the concept of opportunity cost. However, if EPA seeks to improve society's net wealth, it should base its perspective on this concept of determining the most highly valued alternative use, from society's point of view, of the economic resources needed to implement the proposed regulation. EPA instead, relies on how quickly regulated firms will recover the cost associated with compliance.

Letters:
Mercatus Center, OAR-2003-0012-0627, 0828 p. 39-43, 47

Our Response:

Our regulatory cost accounting is based on assessing the engineering or technical costs associated with controls that will be incorporated into engines affected by this rule over the time of implementation. This compliance cost accounting is consistent in approach with other mobile source rules issued by EPA (e.g., Tier 2 Light-Duty Vehicle, Heavy-Duty Diesel Vehicle) in the recent past, and it is consistent with the type of cost analysis the Office of Management and Budget (OMB) required Federal Agencies such as EPA to provide along with the regulation itself.

EPA does attempt to examine the regulation’s effect on society in its regulatory impact analysis (RIA). In that document, EPA produced a benefits analysis estimating the value from the emission reductions expected to occur. The results of this benefits analysis are then compared to the cost to present some overall conclusions on the effects of this regulation on society such as total net social benefits. In addition, EPA also prepared an economic impact analysis that estimates impacts to producers and consumers affected by this regulation, and does so from a standard microeconomic framework examining changes in consumer and producer surplus. Such a framework explicitly considers opportunity cost in estimating impacts. Hence, EPA does examine the opportunity costs of resources used to comply with this rule and the net effect on society through the benefits and economic impact analyses instead of analyzing such effects through the compliance costs.

The commenter asserts that we have used our cost accounting approach to imply that regulated industries will get some return on their investments in R&D, redesign, and other fixed costs. This is not the case. EPA does not typically conduct a financial analysis examining the returns on alternative capital investments from funds expected for use in compliance purposes. Instead, we examine opportunity costs as part of analyzing changes in social welfare in the economic impact analysis and RIA.

We should note, however, as the commenter acknowledges, that were EPA to adopt the methodology suggested by the commenter, the cost estimates for our programs would be reduced. Thus, while such a change might theoretically lead to our development of a more stringent program (presumably one reason for not finalizing a more stringent program is higher costs) there is no reason to believe it would lead EPA setting a less stringent program than the one being finalized today.

5.3 Engine-Related Costs

5.3.1 Engine Fixed Costs

5.3.1.1 EPA Has Underestimated the Cost of Compliance to Engines Between 75 hp and 100 hp

What Commenters Said:

AEM commented that the RIA presumes that all engines above 75 hp are already equipped with electronic engine controls that were added to comply with the Tier 3 standards. However, there are some popular engine models in the 75 to 100 hp (56 to 75 kW) range that will not have full electronic engine controls or unit fuel injection systems for Tier 3. In order to comply with Tier 4, AEM also noted, these engines will experience a more significant cost increase than is currently stated in the RIA cost analysis.

Letters:
Association of Equipment Manufacturers, OAR-2003-0012-0669, 0670 p. 13

Our Response:

The commenter does not provide enough information for us to know what engines or what engine manufacturer(s) intend to sell Tier 3 engines in the 75-100hp range without electronic engine controls. As discussed in section II.A.5 and section VI.C of the preamble, we believe that engines in the 75-100hp range will indeed be equipped with electronic engine controls in the Tier 3 timeframe (i.e., the Tier 4 baseline). We believe this based on our own engineering judgement and on conversations with engine manufacturers. In fact, we believed this strongly enough to included costs for electronic controls on 75-100 hp engines in the Tier2/3 rule. As pointed out in Chapter 4 of the RIA and section II.A.5 of the preamble, moreover, 2004 MY certification data, which reflects controls engine manufacturers are using to comply with Tier *2* rules, already shows substantial migration of electronic engine controls into engines in this power category (on the order of 20 % of such engines). We believe these data corroborate our earlier engineering predictions that these technologies will be needed to comply with the Tier *3* rule, and make clear that EPA's projection, that electronic fuel systems will be a typical component of the 75-100 hp engines prior to Tier 4, is reasonable.

5.3.1.2 EPA Has Underestimated the Cost of Compliance to Engines under 75 hp

What Commenters Said:

SBA's Office of Advocacy commented that EPA's RIA indicates that for engines below 75 hp, aftertreatment technology required by the proposed rule will cause per unit costs to rise significantly. Even under EPA's conservative cost estimates, the costs for engines between 50 and 75 hp will amount to approximately one quarter of the cost of these engines. There is reason to believe that EPA's cost estimates for small hp engines/equipment is too low. Other government regulators have devoted significant time and effort to estimating per unit costs for engines below 75 hp. The European Union commissioned a study of the feasibility of requiring PM aftertreatment for these small nonroad diesel engines. This study found that the cost of PM aftertreatment would come to $1,800 per engines between 25 and 50 hp and $3,775 per engines between 50 and 100 hp. The same study found that these engine classes currently had mean costs of $2,000 and $3,500, respectively, and that PM aftertreatment alone would amount to 75 percent and 92 percent of the per unit cost, respectively. This analysis demonstrates that the proposed rule is likely to increase dramatically the cost of nonroad diesel equipment produced by small equipment manufacturers.

Letters:
U.S. Small Business Administration Office of Adovocacy, OAR-2003-0012-0815 - 0818 p. 4-5

Our Response:

We disagree with the commenter (U.S. Small Business Administration- Office of Advocacy, or SBA Office of Advocacy) that this report is a basis to state the EPA has underestimated the costs of the Tier 4 standards.

During the development of our proposal, we reviewed the report referenced by the commenter, “Feasibility Study on a Third Stage of Emission Limits for Compression Ignition Engines with a Power Output Between 18 and 560 kW”, written by VTT Processes for the European Commission (“the VTT report”). We disagree with the commenter that this report is a basis to state the EPA has underestimated the costs of the Tier 4 standards. The VTT report is well over 60 pages long, and the cost information referenced by the commenter is presented in a single table with no references or description of how the costs were estimated. The cost estimates cited by SBA Office of Advocacy are in Table 9 of the VTT. The table includes a row labeled “Estimated mean costs of aftertreatment”, and it provides 4 values covering engines with a sales weighted power of 27.5kW, 56kW, 102.5kW, and 345kW. No references are provided for the cost estimates, and there is no description of what the “aftertreatment” is (i.e., what type of aftertreatment, the size, additional hardware if any, etc.). The report does not specify what is the baseline engine hardware for the cost estimates. The text indicates the estimates in the table “only include hardware and engineering costs”, but there is no description of the hardware and no description of what engineering costs are estimated and what portion of the costs are for engineering vs. hardware. It is well settled that comments containing no substantive information, but rather mere undocumented assertions, require no response. See, e.g. Lead Industries Ass,n v. EPA, 647 F. 2d 1140, 1167 (D.C. Cir. 1980); see also section 307 (d) (6) (B) of the Act, which requires response only to “significant comments”.

EPA has specified every aspect of our engine and equipment cost estimates in Chapter 6 of the RIA. This Chapter, which is devoted only to engine and equipment costs, is more than 90 pages long and contains more than a dozen technical references. Chapter 6 of the RIA includes the following types of information:

- Baseline engine configuration and hardware
- Tier 4 control engine technology hardware definition
- Aftertreatment substrate volume, washcoat precious metal loading, and regeneration system specifications and cost estimates
- Cost estimates for each element of technology package hardware projected to be used to comply with Tier 4
- Detailed description of engine volumes used in the cost estimates
- Description of how fixed costs were estimated

The VTT report contains none of this information. Given the complete lack of description of what the cost estimate is or how it was derived, the VTT report provides no basis for comparison to EPA's cost estimates for the nonroad Tier 4 standards.

We do not disagree with the comment that for some engine power categories, the costs of the Tier 4 program may be on the order of 25 percent of the cost of the engine in the near term in some cases. However, as discussed in response to comment 7.2.5, we disagree with the commenter that this cost increase cannot be absorbed by the market. Please see our response to comment 7.2.5.

5.3.1.3 EPA Has Underestimated the Fixed Costs for Engines in the Proposed Rule

What Commenters Said:

AGCA/NAHB commented that because of the diversity in the marketplace, the emissions reduction solutions (i.e., resolving space issues and maintaining suitable temperature ranges) will have to be specifically engineered for a large number of equipment designs and uses. Further, AGCA/NAHB stated that it is possible that each specific engine could require a complex redesign for each specific equipment application.

Cummins also commented that we have underestimated the engine fixed costs, but did not provide any additional discussion or supporting documentation. Cummins also noted that it would be willing to share information with EPA regarding these costs on a confidential basis.

Letters:
Associated General Contractors of America/National Association of Home Builders, OAR-2003-0012-0791, p. 10
Cummins, Inc., OAR-2003-0012-0650 p. 9

Caterpillar and Cummins commented that we did not included costs associated with upgrading test facilities for transient testing of engines up to 560 kW, or the significant costs for upgrading facilities to accommodate transient testing of engines over 560 kW.

Letters:
Caterpillar, OAR-2003-0012-0812, p. 4

Cummins, OAR-2003-0012-0650, p. 6

Our Response:

We have received confidential comments from Cummins. Based in part on this commenter's suggestion and confidential data, we have developed a more detailed method for estimating research and development costs. Applying this new method increased our estimate of research and development costs for Tier 4 by approximately 50 percent. These additional fixed costs are discussed in section 6.2.1 of the RIA.

As for the comment about each engine requiring a complex redesign for each equipment application, we disagree with this comment. For example, today's nonroad equipment uses a wide variety of radiator sizes and styles. Further, these radiators can be installed in any number of places and any number of orientations within the piece of equipment provided certain design constraints specified by the engine manufacturer are met. Engine manufacturers do not develop new engines to accommodate every possible combination of designs and orientations that may occur in the equipment. We think it will be similar for nonroad equipment under Tier 4. Engine manufacturers will specify a choice of one or two options (e.g., one device with an oval can and one with a round can) per engine model. Further, the engine manufacturers will specify the minimum and maximum distance from the engine that the device can be installed. This generic design must then be accommodated by the equipment manufacturer in their design process. This would leave the equipment manufacturer with a wide variety of possible designs (device mounted vertically, horizontally, transversely, etc.) within the design constraints specified by the engine manufacturer. We have accounted for the cost of a large number of equipment redesigns reflecting the work required to do this.

As for comments regarding certification costs, we have included costs for transient testing of engines under 750hp. We have included incremental costs of $4,500 per engine family certification for this testing on engines under 750hp. We assume that such testing could be done either in-house with, perhaps, upgrades to existing facilities, or could be contracted out to various test labs around the country. We believe that $4,500 should cover such certification testing. As for costs to accommodate transient testing of engines greater than 750hp, we are not including these costs in the final rule since we are not finalizing requirements for transient testing of these engines.

5.3.1.4 EPA's Direct Cost Estimates Implicitly Assume a Relatively Large Manufacturer

What Commenters Said:

The Mercatus Center commented that a relatively large firm can spread EPA's "fixed costs" over thousands more units than a relatively small firm. For instance, EPA estimates that the industry's total R&D expenditures for the 25 to 75 hp engine category over 2003 through 2012 would total approximately $73.3 million (in 2001 dollars) before discounting. If each of the 28 firms must spend approximately the same amount on R&D to arrive at end results that will earn EPA certification, then each firm—regardless of relative size—must spend approximately $2.6 million on R&D. For Kubota and its 28.6% market share, this $2.6 million can be spread over approximately 76,000 units annually (starting in 2007 when the regulation becomes effective)—or about $34 an engine. A firm with a 1 percent market share can spread its R&D over approximately 2,600 units—or about $1,000 an engine.

Letters:
Mercatus Center, OAR-2003-0012-0627, 0828 p. 44

RIA states: "We are projecting that manufacturers would need to do this R&D to sell engines in Europe, Japan, Australia, and Canada because we expect that similar emission standards would be required on a similar timeframe for each of these regions or countries. Therefore, we have attempted to attribute the costs of R&D to the total engine sales for these regions. Since we do not have sales data for every manufacturer showing what percent of their engines are sold in the US relative to those other regions, we have used Gross Domestic Product (GDP) as a surrogate of sales. As a result, we have attributed only a portion of the R&D expenditures to engine sales within the United States. Of the countries expected to have nonroad emission standards of similar stringency to our proposed standards, U.S. GDP constitutes 42 percent of the total. Therefore, we have attributed 42 percent of the R&D costs to U.S. sales."

However, the Mercatus Center commented, a firm (such as Kubota) with a 28.6% market share of the United States market is far more likely to sell engines in other countries than a firm with less than a 1% share of the U.S. market. Apparently, EPA estimates that *total* R&D expenditures – worldwide – will amount to approximately $174.5 million. (That is – per EPA's attribution method – 42% of $174.5 million produces the $73.3 million mentioned in the first bullet.) Hence, each of the 28 firms doing R&D actually must spend approximately $6.2 million worldwide to arrive at results that will pass regulatory muster. For the relatively small U.S. firm selling only in the United States, the per engine R&D cost becomes about $2,380 – compared to Kubota's (approximate) $34 an engine.

Letters:
Mercatus Center, OAR-2003-0012-0627, 0828 p. 44-45.

The North American Equipment Dealers Association and the USA Rice Federation commented that on page 28361 the Agency states that cost savings will accrue for manufacturers from the onroad program. As stated before, this is a questionable assumption at best and is made by EPA to put their cost benefit ratio in the best light. In comments by the Association of Equipment Manufacturers made on June 12,2003 in Chicago, IL, Darrin Drollinger pointed out concerns over the transferability of onroad technology to all size engines of the nonroad sector. If these concerns are valid, the commenters noted, then manufacturers will not accrue savings, and the resulting costs will be invariably passed down to the producer level.

Letters:
North American Equipment Dealers Association, OAR-2003-0012-0647, p. 5
USA Rice Federation, OAR-2003-0012-0652, p. 4

The Mercatus Center commented that EPA implicitly Assumed that firm size does not affect information costs re meeting regulatory requirements. The *RIA* states that "those manufacturers that sell engines only into the nonroad market would be able to learn from the R&D efforts already underway for both the highway rule and for the Tier 2 light-duty rule. This learning could be done via seminars, conferences, and contact with highway manufacturers, emission control device manufacturers, and the independent engine research laboratories conducting relevant R&D." What EPA leaves unsaid, however, is that manufacturers that sell engines only into the nonroad market tend to be smaller than manufacturers that sell into both markets. Smaller firms may be less able to afford sending employees off to "seminars" and "conferences" than larger firms. Hence, while smaller firms would not violate any physical laws by attempting to learn in the ways suggested by the *RIA*, they may very well find that their costs of doing so exceed the costs faced by larger firms.

Letters:
Mercatus Center, OAR-2003-0012-0627, 0828 p. 45.

Our Response:

The R&D expenditures for 25-75 hp engines (the $73.3 million noted by the commenter) represent engine R&D for two sets of emissions standards—the 2008 standards and the 2013 standards. These really should be broken down as $28 million for the 2008 standards and $45 million for the 2013 standards. As a result, the full R&D expenditure of $73 million would not need to be recovered at one time. Further, the commenter suggests that the full costs—$2.6 million per firm (73 divided by 28 firms)—would be recovered in one year. For Kubota, as in the commenter's example, this would be $2.6 million recovered on Kubota's 76,000 engines sold, or $34 dollars per engine. This is not correct. Instead, we would estimate that the firm would recover the costs over five year's worth of sales (ignoring sales growth this would be 380,000 engines in this Kubota example) or only $7 per engine. Similarly, for the firm with only 1% market share, the costs would be recovered over 13,000 engines (2,600 times 5 years) or $200 per engine. This recalculation does not address the commenter's point, but it helps clarify the erroneous characterization of our cost estimates.

The comments summarized here are concerned with the fixed costs necessary to develop and apply Tier 4 emission control technologies to engines and how those costs are recovered across product lines with limited production or sales volumes in the United States. The comments are based upon two erroneous assumptions regarding the nature of low volume engine manufacturers. The first assumption is that low volume engine manufacturers (i.e., those manufacturers that only sell a few hundred to a few thousand engines in the United States) have even lower or no sales volume outside of the United States. Secondly, the commenter assumes that low volume engine manufacturers are inherently small firms with limited capacity to develop new technology. In fact, neither assumption is valid for the engine manufacturers currently certifying to the U.S. Tier 1 and Tier 2 emission standards.

Engine manufacturers provide estimates of projected U.S. directed production volumes to EPA as part of the emission certification process. These projections are considered to be confidential business information and are not disclosed by EPA or the companies to the public.[27] In RIA chapter 6, we describe an analysis of this data used by EPA to estimate fixed cost for research and development. Using a similar process, we have specifically looked at the projected U.S. directed production volumes for all engine manufacturers certifying 2004 model year engines in the power range from 25 to 50 horsepower (the commenters seem particularly concerned with this issue for the smallest horsepower categories). In that power category, three nonroad engine manufacturers serve the market with more than an 80 percent share. The remainder of the projected U.S. directed production volume in this market are from 18 manufacturers each with less than 5 percent of this market (most with much less than 1 percent). The commenters have assumed that some of these 18 manufacturers are likely to be small businesses based in the U.S. without

[27] Emission data and some other engine characteristics provided as part of the certification process are public available on EPA's website (www.epa.gov/otaq/certdata.htm).

significant sales volume outside of the U.S. over which to spread development costs. In fact, none of these manufacturers are small U.S. based companies and all of these companies produce engines in significant volumes for other world markets.[28] Typical of these companies is Isuzu, a large automotive engine manufacturer. Isuzu sells a limited number of diesel engines in this market, but worldwide sells a significant number of diesel engines for nonroad and on-highway engines. We appropriately expect that an engine Isuzu might develop to meet the Tier 4 standards in the U.S. will benefit from developments made to comply with the Light Duty Tier 2 program, the Heavy-Duty 2007 program, the European EURO IV and V highway standards as well as similar standards in Japan.

The commenter's assumptions and the consequences alluded to in their comments are likely to be the very reason that the engine market appears the way it does. It is difficult to understand, as the commenter notes, how a true small volume manufacturer could compete in this market against much larger companies especially given the high fixed costs necessary to develop new engine products. Conversely, it makes sense that a large diversified manufacturer might be able to serve a relatively small market segment at a low cost by adapting a product developed for a separate and much larger market. A review of the engine manufacturers certifying engines in the 25-50 horsepower range in the U.S. today leads us to believe that there are no true small volume engine manufacturers. The analysis suggests that two kinds of diesel engine manufacturers serve this market. The largest volume of engines come from a relatively small number of dedicated nonroad diesel engine manufacturers that sell engines in high volumes. The remainder of the market is served by manufacturers who can at a relatively low cost adapt products developed for other nonroad or on-highway markets to the U.S. nonroad market.

Given these market characteristics, we disagree with commenters suggesting that EPA was wrong to assume in our cost estimates that nonroad diesel engine manufacturers will benefit from the learning and transfer of technologies developed for on-highway engines. One commenter suggests that such transfer may in fact not occur due to technical issues (i.e., the technology is not applicable to small nonroad diesel engines) and thus the development cost will be higher. See response to comments section 3.2 for detailed responses to the question of technology transfer and the general feasibility of the Tier 4 emission standards. Another commenter is apparently concerned that the cost of learning will be disproportionately high for the hypothetical small volume manufacturer posited in their comment. As we describe here, the market is not currently served by manufacturers of the type assumed by the commenter and thus the comment is not relevant to the estimate of costs for the Tier 4 program. Further, even were such a company to exist, we find it hard to imagine that it would choose to design new products in a vacuum. We believe such a manufacturer would choose to learn from technical publications and other sources, perhaps even at a higher rate than a larger company for the very reason that such a notional small company could not afford to develop new technologies (emissions or otherwise) on their own. It is simply far cheaper and easier to learn from the experience of others documented in technical papers than it is to recreate the original work that went into the paper. Assuming, therefore, that this hypothetical small volume manufacturer is already attending technical conferences to learn, there is very little additional cost for them to at the same time learn about emission control advancements especially as those advancements are commonly integral to advancements in other areas of engine design and performance.

We therefore disagree with the commenters that EPA has underestimated the costs for research

[28] Two of the 18 companies are U.S. based companies, Cummins Incorporated and John Deere Powersystems. However, neither of these companies are small volume engine manufacturers as described by the commenters.

and development related to the Tier 4 program for low volume engine manufacturers.

5.3.2 Engine Variable Costs

5.3.2.1 EPA Has Underestimated the Variable Costs for Engines in the Proposed Rule

What Commenters Said:

Cummins commented that EPA underestimated engine variable costs, but provided no additional discussion or supporting documentation; however, Cummins noted that it would be willing to share information with EPA regarding these costs on a confidential basis.

Letters:
Cummins, Inc., OAR-2003-0012-0650 p. 9

Lister Petter commented that the likely costs of aftertreatment systems for smaller engines remains unclear. The cost of an active self-regenerating PM trap is projected to be about $1,000, which is a prohibitive cost for engines below 56 kW.

Letters:
Lister Petter, OAR-2003-0012-0155 p. 2

Our Response:

Cummins stated that we had underestimated some of our engine variable costs and provided a factor by which we had underestimated them. However, no additional information was provided to substantiate the factor making it impossible to understand why Cummins believed their number to be more accurate than EPA's engine variable cost estimate and the substantial data underlying EPA's estimate. Some of our engine variable costs were developed with the aid of external industry experts under contract to EPA and were peer reviewed by engine manufacturer representatives, while others were developed by external experts under contract to EPA using input from industry and from the Manufacturers of Emission Controls Association (MECA) which subsequently served as the basis for both the NRT4 rule and our 2007 HD rule. MECA provided positive comment in response to our NRT4 proposal and stated general agreement with our estimates (see response to 5.1.1 above). Further, a recent report prepared for MECA shows emission control device cost estimates that are generally consistent with our cost estimates.[15] Lastly, a recent industry presentation at the American Trucking Association Diesel Summit II showed dramatic decreases in the level of precious metals used in NOx adsorbers between 2001 and 2003.[16] On a normalized scale, the precious metal content in the NOx adsorbers being researched by the presenter's company had decreased to 35% of their original levels. This suggests that the estimated precious metal loadings we have used in generating our cost estimates may be slightly high and, therefore, our cost estimates may be slightly high. Since precious metals account for 40-50% of our estimated NOx adsorber costs and 15-25% of our CDPF costs, any future reductions in precious metal loadings below our estimated loadings could have a significant downward impact on the cost of these devices in the Tier 4 timeframe.

Lister Petter suggests that a cost of $1000 is prohibitively expensive for engines <75hp. Our cost estimates are not this high. We have estimated total costs, not just the PM trap, at ~$600 to ~$700 for engines in the 25-75 hp range where PM traps are expected to be used to comply with the standard. We have also analyzed the percentage of such a cost increase relative to the price of equipment. For some types of equipment, the percentage of cost-to-equipment price is only in the 1-3% range, regardless of power. For others, the percentage is 5-10%, again regardless of size. The point being that it depends more on the type of equipment than it does on its size. See response to 5.1.2 for more on this issue.

5.3.3 Engine Operating Costs

5.3.3.1 EPA's Projected Operational Savings from Increased Oil Change Intervals Is Overstated

What Commenters Said:

AED and AEM commented that EPA based its projected maintenance savings on a baseline oil change interval of 250 hours, which is no longer the norm. Due to improvements in design and the formulation of today's lubricating oils, Tier 2 engines already have a 500 hour oil change interval, which will be true for Tier 3 engines as well. Even though engine manufacturers specify different oil change intervals based on the fuel sulfur levels, the use of 500 ppm sulfur fuel is unlikely to have an effect on the extension of oil change intervals, and certainly not the 31 percent EPA estimates. Additionally, there is already a significant amount of 500-ppm sulfur diesel fuel being marketed throughout the U.S. in the nonroad diesel pool today, which would minimize any observed gain in oil change interval. In fact, there is evidence to suggest there may be a decrease in recommended oil change intervals once exhaust gas recirculation (EGR) is implemented. Therefore, the expected oil change interval extensions (including the estimated 4 percent with the 2010 introduction of 15 ppm fuel), will have an insignificant effect on lowering maintenance costs when compared to the added maintenance required for the catalyst aftertreatment, the loss of fuel efficiency, and increased cost per gallon.

Letters:
Associated Equipment Distributors, OAR-2003-0012-0831 p. 3
Association of Equipment Manufacturers, OAR-2003-0012-0669, 0670 p. 12

FWEDA, NAEDA, OMEDA, and the USA Rice Federation commented that manufacturers, not EPA, should be estimating any changes to the oil change intervals due to the use of reduced sulfur fuel. In addition, EPA has not accounted for the fact that reduced intervals and wear will have a sizeable negative economic impact on dealers who perform service work and replace parts. In this context, EPA cites the benefits of the rule without adequately considering the costs.

Letters:
Far West Equipment Dealers Association, OAR-2003-0012-0679 p. 5
North American Equipment Dealers Association, OAR-2003-0012-0647 p. 5
Ohio-Michigan Equipment Dealers Association, OAR-2003-0012-0747 p. 5
USA Rice Federation, OAR-2003-0012-0652 p. 5

FWEDA commented that EPA's estimates for the cost of oil changes are low. The current price for filter changes on a 40 hp farm tractor is often close to $400 and filter changes for larger tractors, combines and construction equipment cost even more. There is also a cost associated with transporting the equipment to a dealership. USA Rice Federation indicates EPA's estimates on page 28445 of the proposal preamble of "$8.00 to $400.00" are low, and they go on to say if EPA cannot accurately gauge prices for a basic service, how does the agency expect to evaluate costs of the overall rule.

Letters:
Far West Equipment Dealers Association, OAR-2003-0012-0679 p. 5
North American Equipment Dealers Association, OAR-2003-0012-0647 p. 5
Ohio-Michigan Equipment Dealers Association, OAR-2003-0012-0747 p. 5
USA Rice Federation, OAR-2003-0012-0652 p. 5

ARA commented that the use of low sulfur fuel may not lead to cost savings associated with reduced oil changes and engine servicing. Oil change frequency and servicing schedules are generally established based on other factors such as duty cycle and the environment in which the equipment is used. There is no guarantee that manufacturers will alter their oil change requirements.

Letters:
American Rental Association, OAR-2003-0012-0612 p. 3

Our Response:

Regarding the comments from AED and AEM, we disagree with the comments that the baseline oil change drain interval EPA used (250 hours), is not appropriate. The commenters present no data to support their suggestion that engine manufactures have extended the recommended oil change interval for Tier 2 (yet alone Tier 3, which is still several years away). EPA does not dispute that some engine companies may have recommended oil drain intervals greater than 250 hours, but it is also likely some companies have recommended oil drain intervals of less than 250 hours. We choose 250 hours as a value typical for nonroad diesel applications. The data used for our analysis is contained in a memorandum to the docket, "Estimate of the Impact of Low Sulfur Fuel on Oil Change Intervals for Nonroad Diesel Equipment", EPA Docket A-2001-28, docket item II-A-194. This memo indicates that for John Deere, 250 hours is the typical recommended oil change interval, for Detroit Diesel Corporation values of 150, 250, 300, 450, and 500 hours are recommended, depending on the specific engine series. The memo indicates that for Caterpillar's current products, high load applications have an oil drain interval of 250 hours, and low load applications 500 hours, while for older Caterpillar applications the oil drain interval was between 250 and 400 hours. After the proposal, EPA contacted John Deere regarding any changes John Deere was planning for Tier 2 products. John Deere representatives informed EPA that they have made no changes for Tier 2 products, and 250 hours remains their baseline recommended oil drain interval.[17] Based on the range of oil drain intervals today, and the absence of data provided by the commenters, EPA has not changed the baseline oil drain interval in our analysis.

The commenter's remakes regarding the use of 500 ppm fuel in some nonroad equipment today appears to imply EPA is "double counting" the benefit of low sulfur fuel. This is not the case. Our analysis of the cost savings from low sulfur fuel is done on a per-gallon basis, and only includes that fuel used in nonroad equipment today which is at the uncontrolled level (i.e., sulfur levels >500 ppm). Therefore, we did not attempt to attribute the benefits of the existing use of 500ppm fuel in some nonroad equipment today to this rulemaking.

The commenters' remarks regarding the use of EGR for the potential for a decrease in future oil change intervals (which is in direct contradiction to the commenters' suggestion that Tier 2 and Tier 3 drain intervals will be extended) is not relevant to the question of how low sulfur fuel will impact oil drain intervals. It may be possible that EGR will impact oil drain intervals, but the question relevant to this discussion is how will the use of low sulfur fuel (with or without EGR) impact oil drain intervals. Based on available information, the use of low sulfur fuel will allow for longer drain intervals independent of the use of EGR.

Regarding the comments from FWEDA, NAEDA, OMEDA, and USA Rice, we agree with the commenters that engine manufacturers, not EPA, provide end-users with recommended drain intervals. In part, our analysis relies on the existing recommendations from engine manufacturers. EPA's analysis assumes that engine manufacturers will continue to communicate to the end-user accurate information regarding oil drain intervals and the interdependence between oil drain intervals and fuel sulfur levels. This occurs today, and EPA sees no reason why engine manufacturers would stop providing such information to the end-users in the future. Regarding the comment that reduced oil drain intervals will have a negative impact on dealers who perform such services. Our cost analysis appropriately takes into account that the use of low sulfur fuel will reduce costs to society as a whole. However, it is not appropriate in the cost analysis to also estimate reduced revenue for equipment dealerships (just as EPA has not included in the cost estimates the reduced revenue at hospitals for the lower hospital visits due to the health benefits of this program.) We have also not included the potential impact of less frequent oil drain interval on equipment dealers and service stations in our economic impact analysis. We believe that any impact would be a small portion of those industries' total revenue.

In response to the comment which stated that our oil changes estimates were low, to the extent the cost of an oil change for a 40hp tractor is $400, then our cost estimate of the savings from the use of low sulfur fuel is conservative. We performed a sensitivity analysis of our oil change interval extension cost spreadsheet (found in Chapter 6 of the RIA). If we were to increase the cost of an oil change in all power ranges to $400 (except for those larger power categories for which we already estimated a cost greater than $400), then our fleetwide maintenance savings estimate for the program increases from 3.2 cents/gallon to 13 cents/gallon. However, we have not increased the cost estimate for an oil change based on the comment received. The $400 estimate appears to EPA to be very large, and to the extent it is accurate, the oil change estimate for a 40hp tractor may not be representative of nonroad equipment as a whole. With respect to the comment from USA Rice that the proposal preamble on page 28445 of the Federal Register indicates EPA estimated oil change costs to be $8 to $400 and these costs are to low, the commenter is in error. In fact, 68 FR 28445 states, "We have used a 35 percent increase in oil change interval along with costs per oil change interval of $70 through $400 to arrive at estimated savings associated with increased oil change intervals." We would agree with the commenter that an $8 estimate for an oil change is to low, but EPA made no such estimate.

Regarding ARA's comment, we disagree with the comment that lower sulfur fuel not lead to cost savings. As documented by EPA, engine and equipment companies recommend longer oil drain intervals for equipment operated on low sulfur fuel today (see "Estimate of the Impact of Low Sulfur Fuel on Oil Change Intervals for Nonroad Diesel Equipment", EPA Docket A-2001-28, docket item II-A-194). The commenter presents no data which would indicate engine and equipment companies existing recommendations are incorrect, or would be different in the future. In addition, the rulemaking record contains substantial technical information (independent of the nonroad engine and equipment companies recommendations) which indicates the use of low sulfur fuel will have a benefit for nonroad engines and equipment and does have the potential to allow longer oil drain intervals (see section VI.B of the preamble for this final rule, as well as "Estimate of the Impact of Low Sulfur Fuel on Oil Change Intervals for Nonroad Diesel Equipment", EPA Docket A-2001-28, docket item II-A-194, and also "Economic Analysis of Vehicle and Engine Changes Made Possible by the Reduction of Diesel Fuel Sulfur Content", ICF, December 1999, EPA Docket A-2001-28, docket item II-A-75). Also, to the extent engine manufacturers who do not currently have recommendations for longer oil drain intervals for engines operated on low sulfur fuel (500 ppm S or 15 ppm S), or if end-users are not aware of the recommendations even when they exist, the use of low sulfur fuel will still have benefits for the equipment owner. As discussed in the preamble (Section VI.B), as well as in the two references cited above (Air Docket A-2001-28, items II-A-75 and II-A-194), the use of high sulfur fuel results in higher wear rates of a number of key engine components, including piston rings and cylinder liners. For example, Figure 3 in Appendix A of "Estimate of the Impact of Low Sulfur Fuel on Oil Change Intervals for Nonroad Diesel Equipment" indicates that one engine manufacturer predicts that overall engine life can be extended by nearly 10 percent by reducing fuel sulfur from 3,000 to 1,000 ppm.

5.3.3.2 EPA Has Underestimated the Operating Costs for Engines in the Proposed Rule

What Commenters Said:

Cummins commented that EPA underestimated the engine operating costs, but provided no additional discussion or supporting documentation. The commenter noted that it would be willing to share information with EPA regarding these costs on a confidential basis.

Letters:
Cummins, Inc., OAR-2003-0012-0650 p. 9

Our Response:

The commenter provided confidential information that suggested a higher fuel economy impact that the one percent we have used for CDPF/NOx adsorber equipped engines. However, the commenter provided no test data or technical information supporting their estimate. We continue to believe that our estimated fuel economy impact is appropriate. (see section 6.2.3.3 of the RIA for more discussion on fuel economy impacts). See also, EPA's recent Highway Diesel Progress Review Report 2 summarizing industry data regarding the impact of advanced diesel emission control technologies on fuel economy (EDOCKET OAR-2003-0012-0918).

The commenter also provided confidential statements regarding oil change intervals. We disagree with these statements (see response to 5.3.3.1).

5.3.3.3 EPA Has Not Considered the Need to Retrofit Existing Equipment if Only Low Sulfur Fuel is Available

What Commenters Said:

The Idaho Wheat Commission (IWC) commented that EPA should address the possibility that low sulfur fuel would necessitate the retrofit of farm equipment (i.e. if higher sulfur fuels are not available for use on existing equipment) and should evaluate the resulting economic impact to the agricultural sector. The commenter (IWC, et. al.) recommended that in light of the potential adverse economic impacts to farmers, farm equipment should be excluded from the proposed rule.

Letters:
Idaho Wheat Commission, et. al., OAR-2003-0012-0645 p. 1

Our Response:

Although the comment is not fully clear to us, we believe that the commenter is referring to the lubricity property of high sulfur diesel fuel and is expressing a concern that some sort of retrofit system would have to be added to protect against damage that may result if lower sulfur (500 ppm or 15 ppm sulfur) fuel has inadequate lubricity. While we agree that fuel lubricity is an important characteristic, and that absent adequate measures low sulfur diesel fuel can have poor lubricity characteristics, we do not believe that a retrofit technology will be necessary to address this issue. Diesel fuel blenders currently add lubricity additives to diesel fuel that may have poor lubricity characteristics in order to ensure appropriate levels of lubricity in diesel fuel. We believe this practice will be applied broadly to nonroad diesel fuel in order to address the concern of the commenter. We have estimated the cost associated with lubricity additives and have included those costs in this program. See our response to 4.7 above.

5.3.3.4 EPA's Cost Analysis Is Invalid as it Relates to Locomotives

What Commenters Said:

GE commented that when evaluating the cost impact of implementing a 500 ppm sulfur requirement, EPA has failed to consider the cost involved in re-optimization of the engine for performance, reliability and emissions. EPA claims that oil change intervals will be extended to offset the higher cost of lower sulfur fuels, but assumes that low sulfur fuel would be far less corrosive than current nonroad diesel fuel. EPA's estimates do not apply in the case of locomotives since locomotive useful engine oil life is driven by insoluble contamination build up, followed by fuel or water leaks, viscosity increase and alkalinity. When changing the timing, the insolubles could increase, which could actually shorten useful oil life.

Letters:
General Electric Transportation Systems, OAR-2003-0012-0784 p. 6

Our Response:

We disagree with these comments. It is unclear what the commenter means when saying locomotive engines will need to be “re-optimized” when run on 500 ppm sulfur fuel. The commenter says that timing will need to be retarded, but it is unclear why. The commenter suggests that it has extensive laboratory data regarding the impact of fuel properties on locomotive engines, but no data was provided or cited in the comments. As discussed in response to comment 5.3.3.1, substantial data exists which indicates low sulfur fuel does provide a potential for cost savings, including the ability to extend oil drain intervals. EPA has this data in the rulemaking record (including at the time of the proposal).

Finally, as discussed in response to comment 5.3.3.1, to the extent that an end-user does not lengthen oil drain intervals when operating on low sulfur fuel, other benefits will likely occur, including an extension of the engine's operating life. Please see response to comment 5.3.3.1 for additional discussion.

5.3.3.5 Other Factors will Cause Equipment Operating Costs to Increase

What Commenters Said:

AED commented that additional maintenance for catalyst after-treatment, decreased fuel efficiency, and higher fuel costs will all likely cause equipment operating costs to increase.

Letters:
Associated Equipment Distributors, OAR-2003-0012-0831 p. 4

ARA commented that we did not considered the costs of maintenance and/or replacement of failed emission controls and associated equipment down time.

Letters:
American Rental Association, OAR-2003-0012-0612 pp. 2-3

Our Response:

We do not disagree with the AED comment and, in fact, have estimated costs associated with increased maintenance not only for the aftertreatment systems but also the newly required closed-crankcase ventilation system (newly required for turbocharged engines only). We have also included costs associated with fuel economy impacts and for the incrementally higher cost low sulfur fuel.

As for the ARA comment, we have included costs associated with increased warranty expenses for engine manufacturers. These costs include a three percent near-term warranty claim rate and a one percent long-term warranty claim rate, along with part replacement costs and labor associated with that replacement (see tables throughout section 6.2 of the RIA). See also our response in section 5.4.2.3.

5.4 Equipment-Related Costs

5.4.1 EPA's Variable Cost Estimates for Nonroad Equipment Should Be Increased to Be Consistent with Industry Practice

What Commenters Said:

AEM commented that EPA has assumed equipment manufacturers would apply only a 29 percent mark-up on the variable costs associated with installing new hardware and sheet metal. A survey of nonroad manufacturers indicates that this value is underestimated, and that it is more common industry practice to use a variable cost mark-up of 2 to 1 to help cover indirect costs. The estimated range of cost increases from 2 to 35 percent are closer to the true cost impacts of the Tier 4 regulation and the greatest change in relative cost impact will be on the smaller equipment less than 100 hp that will experience a cost increase from 6 to 35 percent. AEM provided additional discussion on this issue and additional analysis that incorporates their revised assumptions. AEM also included revisions to Table V.C-1 in the RIA and presents their revised cost estimates in Table 5-1 of their comment letter. These revisions are based on an example piece of equipment for each of the five Tier 4 power categories, an assumption that the 50 hp engine is not already equipped with engine electronics and unit fuel injection (but included the variable cost for adding cooled EGR to this category), and deleted the maintenance cost savings associated with increased oil change intervals in determining the Incremental Operating Cost Increases.

Letters:
Association of Equipment Manufacturers, OAR-2003-0012-0669, 0670 p. 13-14

Our Response:

The AEM comments included the following table as a revised version of a table that appeared in our draft RIA.

AEM Projected Equipment Costs Increases of Tier 4 Controls

Type of Machine	Gen Set	Fork Lift	Backhoe	Dozer	Loader
Horsepower	**20 HP**	**50 HP**	**76 HP**	**500 HP**	**750 HP**
Model Year	2008 MY	2013 MY	2012 MY	2011 MY	2011 MY
Displacement	1.0 L	2.5 L	3.9 L	18 L	23 L
Aspiration/Combustion Type	N.A. DI	N.A. DI	Turbo DI	Turbo DI	Turbo DI
Fixed Costs					
Engine Control R&D	$15	$44	$27	$195	$774
Engine Tooling	$5	$6	$15	$74	$70
Engine Certification	$10	$13	$11	$29	$48
Equipment Redesign*	na	na	na	na	na
Equipt Add'l Hardware/Labor	$0	$18	$55	$135	$139
Engine Variable Cost					
NOx Adsorber			$590	$2,070	$2,595
CDPF		$446	$656	$2,771	$3,521
CDPF Regeneration System		$169	$183	$324	$374
DOC System	$136				
Cooled EGR System		$112			
CCV (turbos)			$43	$71	$81
Fuel Injection System	$704	$340			
Incremental Engine/Equipt. Cost Near Term	**$870**	**$1,148**	**$1,580**	**$5,669**	**$7,602**
Estimated Baseline Equipment Price New	$5,000	$15,000	$50,000	$575,000	$620,000
Est. Mfr. Cost [Price / 2.0 = Mfr. Cost]	$2,500	$7,500	$25,000	$287,500	$310,000
Projected Equipment Cost Increase	**34.80%**	**15.30%**	**6.32%**	**1.97%**	**2.45%**

The costs shown in this table differ from how EPA estimated the costs in a few key ways:

- Fuel injection system costs are included for the 20hp genset while we included no fuel injection costs for this power range;
- A higher fuel injection system cost than we had estimated due to an assumption that the Tier 4 baseline fuel injection system would not be electronic;
- Inclusion of cooled EGR costs for the 50hp forklift while we would not have included costs for cooled EGR (we include cooled EGR for engines in the 25<=hp<50 range); and,
- No specific line items are included for equipment related costs other than a generalization that equipment manufacturers recover their costs via a 2 to 1 markup reflected in the price of the equipment.

AEM makes no argument for why they believe cooled EGR would be required on the 50hp piece of equipment. There is a fine line, although an important distinction nonetheless, that must be made clear with respect to this table. We have included costs for cooled EGR on engines in the 25 to 50 hp range. However, the standards in what we refer to as the 25 to 50 hp range are, technically, standards for a 19 to <37 kW range. A 50 hp engine would be rated at 37.3 kW and, therefore, would not lie within the 25 to 50 hp range. This explains why our numbers have not included cooled EGR for a 50 hp engine and may explain why AEM has included that cost for a 50 hp engine.[29] We do not agree with AEM's assumption that the 50hp engine will need to add cooled EGR for reasons explained at length in our technological feasibility discussion in section 4.1.4 of the RIA. We also disagree with the assertion that the 50 hp engine will not have electronic fuel injection in the Tier 3 timeframe. An engine of that size lies within the 50 to 75 hp range and, as we explain in detail in section VI.C of the preamble and in section 4.1.4 of the RIA, we believe such engines will indeed have electronic fuel injection systems in the Tier 3 timeframe. We also do not understand, nor does AEM explain, why an electronic fuel injection system would be required for the 20hp engine. Engines in that power range are expected to meet their 2008 standards via engine-out control or, perhaps, through addition of a DOC (and there is ample data in the record showing that many of these engines are already meeting the 2008 standards and will require no hardware changes to comply). Neither of these solutions would require electronic fuel systems. This is discussed in section 4.1.5 of the RIA.

As for the 2 to 1 markup to cover equipment manufacturer fixed costs, there is insufficient information provided in the comments to fully understand the basis for this markup. The commenter referred to a "survey" but did not provide documentation of that survey which leaves us unable to analyze its appropriateness. We have attempted to estimate the costs associated with adding new hardware and redesigning the many types of equipment. We have provided all the details for how we have come up with those estimates, including documentation for the basis of the mark ups we have used.[18] We do not believe it is appropriate to simply assume a 2 to 1 markup to cover costs.

5.4.2 EPA Should Evaluate the Equipment Cost Increases Within Each Power Category

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[29] It is important to note that cooled EGR on a 50 hp engine has already been costed within the context of the Tier 3 rule. It is equally important to note that, were we to assume a 49 hp engine in the example, we would include cooled EGR in our costs and have indeed included those costs for all engines in the 25<=hp<50 range.

What Commenters Said:

AEM commented that the cost impact across the power categories is not a linear relationship. EPA presents the projected cost increase of Tier 4 as a range from 1 to 3 percent of the value of the equipment as determined on the very high-priced equipment whose base price is from $50,000 to over $620,000. AEM further noted that a more realistic portrayal of the cost impact would be to report the range of cost increase for the base majority of equipment sold, which is the segment from 40 to 100 hp (30 to 75 kW), where the cost increase is from 6 to 15 percent.

Letters:
Association of Equipment Manufacturers, OAR-2003-0012-0669, 0670 p. 14

AEM also commented that the variable cost of the new emission control components suggested by Tier 4 could approach the cost of the engine itself for the smaller (and most popular) pieces of equipment. The operating costs of the new equipment will increase as well due to the reduced fuel efficiency and the additional maintenance required for the aftertreatment systems. The Tier 4 standards could result in the disappearance of certain smaller engines in favor of gasoline-powered replacements. AEM further recommended that this cost by category analysis be included in the Pilot Study (see additional discussion under Issue 3.5).

Letters:
Association of Equipment Manufacturers, OAR-2003-0012-0669, 0670 p. 14-15

Our Response:

Our Economic Impact Analysis (EIA) does take a comprehensive look at the cost across relatively narrow engine power categories (e.g., 50-75 hp) and across a broad range of equipment applications (see Chapter 10.3 of the RIA). This analysis is more detailed than the level suggested by the commenter and is similar to the analysis completed at proposal and presented in the Draft RIA. As the commenter notes, these cost as a percentage of equipment price are non-linear as reflected in Table 6.5-4 of the RIA. We have accounted for the characteristics noted by the commenters in our EIA both at proposal and now in our final rule documented in the RIA.

With respect to the comment regarding the costs across power categories, please refer to our response to 5.1.2.

With respect to the cost increases resulting in the disappearance of certain smaller engines in favor of gasoline powered engines, please refer to our response to 7.2.4.

5.4.3 EPA Underestimates the Costs Associated with Small Equipment

What Commenters Said:

SBA Office of Advocacy commented that EPA included a cost for ash maintenance in its RIA, but that cost estimate does not reflect the inconvenience to small equipment consumers (e.g. lawn and garden equipment purchasers) of having to periodically remove, clean, and replace a PM filter. EPA should recognize these application-specific concerns when considering whether to adopt a regulatory option including PM aftertreatment for smaller engines and when estimating costs.

Letters:
U.S. Small Business Administration Office of Advocacy, OAR-2003-0012-0815 - 0818 p. 7

Our Response:

We did include costs associated with CDPF maintenance for all engines so equipped. We did not attempt to include costs associated with inconvenience. We believe that attempting to estimate costs based on inconvenience or other lifestyle factors would be very difficult and is outside the purview of EPA.

Further, we believe it likely that engines below 175 horsepower can be designed such that PM filter maintenance to remove ash will be unnecessary. EPA's recent Highway Diesel Progress Review Report 2 documents two new diesel PM filter designs which in light-duty diesel passenger car applications are designed to be maintenance free for the life of the vehicle. This is accomplished by designing the filter geometry and materials to significantly increase the ash storage volume of the filter. Such filters can store an engine's lifetime ash emissions while maintaining PM control to the emission standards and without excessive build up of exhaust backpressure. Such solutions are equally applicable to nonroad diesel engines.

In our cost analysis, we have assumed that ash cleaning maintenance occurs at the minimum maintenance interval spelled out in EPA regulations (e.g., 3,000 hours for engines <175 hp including the lawn and garden equipment mentioned in the comment). More frequent maintenance is generally not allowed. By using this interval, while believing it likely that actual maintenance intervals will be longer (in fact in some cases unnecessary over the life of the vehicle), we have made a conservative estimate of the potential costs for diesel PM filter ash maintenance.

Finally, it should be noted that the commenter, SBA Office of Advocacy, included in their comments a discussion of the Euromot-EMA report "Investigation into the Feasibility of PM Filters for Nonroad Mobile Machinery", a copy of which is available in EPA Air Docket A-2001-28. In this report, EMA/Euromot discuss two types of active PM filter regeneration methods. One method is similar to the active back-up regeneration techniques we believe nonroad engine companies will use to comply with the Tier 4 program and discussed in detail in Chapter 4 of the RIA. That method is based on a variety of means of providing supplemental heat to the PM filter to increase the exhaust gas temperature to the level at which PM will oxidize. The second method discussed in the Euromot-EMA report for active filter regeneration is the actual removal of the PM filter from the equipment and the subsequent heating of the filter in a specialized oven. Such techniques have been used in mining operations in Europe and the U.S., where each night the filters are removed, placed in an oven to force regeneration, and than reinstalled in the equipment the following morning. We want to be clear that this type of filter regeneration is not the basis for EPA's Tier 4 standards, and, in fact, such a system would likely not be allowed in the U.S. as a means to comply with Tier 4 standards, as it requires PM filter maintenance on a very frequent schedule and would not meet the EPA regulations for minimum PM filter maintenance intervals. To the extent the commenter believes this second type of PM filter maintenance is inconvenient, we would agree, but such systems are not the basis of EPA's feasibility or cost assessments for the Tier 4 standards.

5.5 Example Equipment Costs Used for the Analyses

We did not receive any comments regarding the costs of the example equipment that we used for our analyses in the proposal.

6. LOW-SULFUR FUEL COSTS

A summary of the comments received, as well as our response to those comments are located below. For the full text of comments summarized here, please refer to the public record for this rulemaking.

6.1 Nonroad, Locomotive and Marine Fuel Volumes

6.1.1 EPA Should Complete a Comparative Assessment Between the EPA and Baker & O'Brien Work to Assure That the Underlying Assumptions and Impacted Volumes Are Consistent

What Commenters Said:

Although there are many similarities, several differences can be observed between the Baker & O'Brien report and EPA's analysis with respect to a comparison of distillate consumption estimates. Different fractions were used for the amount of impacted diesel fuel for each end use sector, and EPA should reconcile these variations prior to a final rulemaking. With respect to spillover, the two independent assessments agree fairly well, except that for PADDs 3 and 5, EPA estimates a greater historic spillover (30 and 58 percent vs. 18 and 42 percent, respectively). EPA's estimate for the impacted volume is higher for PADD 3 and EPA exempted the supply volumes of small refiners, whereas the Baker & O'Brien study did not take this into account. In addition, EPA's underestimate of the 15 ppm production volume of nearly 250 kbpd in 2008 appears to be based on PADD 3 and 4 estimates and is the basis for all additional calculations of impacted volumes and the amount of desulfurization needed. The commenter (API) provided additional discussion on these issues and recommended that EPA thoroughly review the differences between its estimate and that made by Baker & O'Brien to affirm the accuracy of the assumptions and analysis in the Draft RIA.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 32-36
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 28-32

Our Response:

Baker & O'Brien (BOB) estimated future NRLM fuel consumption using a process which is broadly analogous to that used by EPA in Section 7.1 of the Draft RIA. BOB first estimates current NRLM fuel use and then increases this use to reflect an estimate of growth over time. BOB's current fuel consumption estimate primarily rely on EIA estimates from their Petroleum Supply Annuals (PSA) and Fuel Oil and Kerosene Surveys (FOKS), but incorporate numerous assumptions, as well.

One similarity between the BOB and EPA estimates for the NPRM of historic NRLM fuel use is that both BOB's and our analyses were based on historic fuel consumption estimates on 2000 data from EIA's FOKS and PSA reports. However, for the final rule, we based our estimates on 2001 data from EIA's PSA, FOKS and the NONROAD emission model. (In Section 2.2 above, we consider very recent data from EIA's 2002 FOKS in evaluating current NRLM fuel use.) The inclusion of 2001 data is generally preferable to estimates based on slightly older data. While this is not likely to cause a large difference between BOB's and EPA's projected NRLM fuel use, to the degree that it is important, it is a reason to prefer the EPA final rule estimate. If the BOB methodology were preferable for other reasons, one could potentially update the BOB estimates using the more recent data., but as will be seen below this is not the case.

The next step in estimating current NRLM fuel use is to separate distillate fuel use which is not covered by the NRLM rule, such as highway diesel fuel use, heating oil use, and diesel fuel used by stationary diesel engines, from NRLM fuel use.[30] As described in detail in Chapter 2 above, EIA's FOKS does not always separate No.2 fuel oil use from No. 2 diesel fuel use, nor does it clearly separate diesel fuel use in stationary source diesel engines (fuel not covered by this NRLM rule) from diesel fuel use in NRLM equipment (covered by this rule). BOB assumed the fractions of No. 1 and No. 2 distillate fuel in each of the FOKS economic sectors which was consumed in NRLM diesel engines. A review of BOB's estimates show many very large differences compared to those made by EPA in Chapter 2.

For example, BOB assumed that 80% of the fuel use in farm equipment was in diesel engines, presumably in equipment covered by the NRLM rule. EPA, on the other hand, used EIA's own breakdown within FOKS that roughly 98% of farm fuel use was diesel fuel (used in diesel engines) and that only 2% was fuel oil (used in crop drying, etc.). As BOB provides no rationale for their 80% figure and EIA's own categorization within FOKS supports EPA's assumption, we see no reason to adjust our estimate.

In another case, BOB assumes that no distillate fuel used in the commercial sector is used in diesel engines, highway or NRLM diesel engines. As discussed in Chapter 2, clearly the commercial sector includes low sulfur diesel fuel used in school bus fleets and other public fleets which are exempt from highway fuel excise tax. While not directly relevant to their estimate of NRLM fuel use, it does seem to indicate that BOB did not look closely at the types of fuel EIA includes in the various economic sectors. EIA's FOKS report also explicitly distinguishes between diesel fuel use and fuel oil use in the commercial sector, with 25% of high sulfur distillate fuel consumed in this sector being designated as diesel fuel and 75% as fuel oil. Being a survey of fuel distributors, this indicates that the fuel purchaser requested either diesel fuel or fuel oil from the distributor. BOB did not explain why purchasers would request diesel fuel when all they needed was fuel oil. Also, as indicated in the EPA NONROAD emissions model, many types of diesel equipment are primarily used in the commercial sector (pressure washers, gas compressors, welders, chipper/grinders, generator sets, etc.). Therefore, zero is clearly not the best estimate available for the percentage of commercial sector fuel used in nonroad equipment. Given BOB's frequent use of FOKS' estimates in their estimation of NRLM fuel use, we believe that the FOKS estimate of high sulfur diesel fuel use, which excludes low sulfur diesel fuel use and high sulfur fuel oil use, is clearly preferable to BOB's assumption of zero use. As described in Chapter 4 above, our own estimate of nonroad fuel use in the commercial sector is based on the NONROAD emissions model. In Chapter 4, we compare fuel consumption estimates using both NONROAD and FOKS.

The next step in projecting the volume of NRLM fuel affected by this rule is to project growth in NRLM fuel use. BOB stated that they based future growth rates for both fuel consumption and domestic fuel production on EIA's 2002 Annual Energy Outlook (AEO), because this was the most recent AEO

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[30] This discussion will use "diesel fuel" to distillate fuel used or believed to be used in diesel engines and "fuel oil" to distillate fuel which is used in boilers, turbines, crop drying, etc.

report available when they began their analysis.[31] EIA issued their 2003 AEO during BOB's analysis. BOB stated that they thought that the fuel usage growth rates from EIA's 2002 report were better than those in the more recent 2003 report. Therefore, BOB did not attempt to update their analysis. BOB did not present any objective reasons to support their preference for EIA's growth rates from 2002. It is inconsistent for BOB to be willing to use a 2002 EIA estimate, presumably due to EIA's reputation, and then simply disagree with an updated forecast from the same organization. It seems that BOB's decision was simply based on the personal preference of the authors. Absent any other information, the decision therefore seems to be quite arbitrary. We decided to update our analysis using EIA's 2003 AEO forecast when it was released. Therefore, our projected fuel usage growth rates will differ from those used by Baker and O'Brien. We see no need to reject EIA's 2003 forecast in favor for their 2002 forecast.

One further difference is that BOB assumed that the production of distillate fuel from domestic refineries would increase in proportion to crude oil consumption by these refineries. We based our estimates of future distillate production directly on EIA's estimates of future distillate production. The difference is that EIA projects significant growth in the use of heavy fuel oils by domestic refiners. This increases distillate production without increasing crude oil consumption. BOB's estimate of future growth in distillate production is therefore too low.

Given these large differences and the lack of any justification for the BOB estimates, it is not surprising that there would be some difference in the estimates of fuel volumes affected by the NRLM rule. However, we do not believe that BOB provided sufficient justification to change our methodology. To the contrary, as described in Section 7.1 of the Final RIA, we have updated our NRLM fuel supply and demand estimates considerably from the NPRM. The revised methodology incorporates many factors not addressed by BOB, such as the downgrade of 15 ppm diesel fuel and jet fuel during distribution. Therefore, we believe that the technical support behind our estimates is much greater than that behind the BOB estimates.

There is a larger issue involved with the projection of current NRLM fuel use - whether to use FOKS as the primary basis for fuel used in land-based nonroad equipment or to use EPA's NONROAD emission model outputs. This issue is addressed in Chapter 2 above. There, we decide to continue using the NONROAD estimates versus those based on FOKS. This leads to a much higher estimate of fuel consumption, both current and future, than those based on FOKS. Thus, EPA projects a much higher nonroad fuel consumption than BOB. This higher fuel volume is fully factored into our cost estimates, including the number of refineries which must invest to produce lower sulfur NRLM fuel. Our analysis includes a sensitivity analysis based on base volumes and growth for nonroad fuel based on EIA.

6.2 Refining Costs

6.2.1 Costs Were Underestimated

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[31] AEO is a comprehensive projection of future energy use in the U.S. AEO covers petroleum, coal, natural gas and other sources of fuel, as well as electricity generation. Its projections are based on historical fuel use, as well as econometric projections of demand for various fuel-consuming services in the U.S. economy, as well as current and future energy efficiencies in providing these services.

What Commenters Said:

The Michigan Farm Bureau expressed concern about the significant discrepancy between the fuel cost increase estimates proposed by EPA (5 cents per gallon) and those from experts in the fuel-refining industry (7-9 cents per gallon). Their concern is magnified by the fact that the industry estimates do not even include the additional cost to be incurred for storage, segregation, transport, and handling of the different fuels.

Letters:
Michigan Farm Bureau, OAR-2003-0012-0625 p. 2

Our Response:

It is not clear which cost estimates by industry experts are being referred to by the Michigan Farm Bureau. In Section 7.2.2.6 of the Draft RIA, we compare our costs to those estimated by Mathpro, who estimated the cost of nonroad sulfur controls for EMA, with assistance from API. There, we show that our costs are quite comparable to Mathpro's estimated costs, after considering changes both highway and NRLM control programs which have occurred since Mathpro performed their studies in 1999 and 2000. In Section 4.6.3 of this document, we also conduct a detailed analysis of the more recent cost estimates developed by Baker and O'Brien for API. Based in part on these evaluations and on the use of updated future cost estimates for natural gas and the likely penetration of advanced desulfurization technologies, our estimate of the cost of 15 ppm NRLM fuel has increased from roughly 5 to 7 cents per gallon.

We also fully account for any increased costs in distributing NRLM fuel due to this rule in Section 7.3 of the Final RIA. Detailed comments on these distribution costs are addressed in Section 6.2.2.

6.2.1.1 Vendor Cost Estimates

What Commenters Said:

API and Marathon believe that we significantly understated the costs incurred by refiners to comply with the proposed rule. API and Marathon noted that in Section 7.2.1.2.4 of the Draft RIA, EPA points out that there are many reasons why the vendor capital cost estimates should be pessimistic. However, they stated, none of these points are persuasive and most studies, including the NPC study have found that vendor quotes are normally low and on unproven technology tend to grow substantially as real world process requirements become better known.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 37
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 33

Our Response:

As the commenters point out, we address the pros and cons of using vendor cost estimates explicitly in the Section 7.2.1.2.4 of the Draft RIA. The commenters point to the NPC study as a basis for discounting vendor estimates. However, EPA considered the way NPC used vendor estimates in developing its own approach to using this information. The issue is primarily one of uncertainty and potential downward bias in applying the generic vendor quotes to specific refining situations. We continue to believe that there are many factors which could lead to higher costs at specific refineries, as well as many factors which could lead to lower costs. One relevant example of the latter is the general realization among the refining community, since the vendor quotes were developed, that interstage strippers will not likely be necessary in most applications to reach 7 ppm sulfur. Yet the cost for these strippers is included in our estimates. Another example is that the vendor cost estimates are based on the best catalysts available at the time. However, since the vendors provided their cost estimates three new lines of catalysts were announced. Akzo Nobel announced a very high activity catalyst named Nebula. Criterion and Haldor Topsoe announced new lines of catalysts this year, named Ascent and Brim, respectively (see Chapter 5 of the RIA). These new catalysts improve the desulfurization reaction rate compared to previous lines of catalysts resulting in the need for less catalyst volume and smaller reactors to reach the same sulfur target. Thus, use of the vendor estimates with appropriate contingency factors still is appropriate, and may even be conservative. It should be noted that we have increased our capital cost contingency factor significantly to better represent the cost of expanded sulfur processing capacity (see Section 6.2.1.2).

6.2.1.2 Capital Cost Contingency Factor

What Commenters Said:

API and Marathon also noted that in Section 7.2.1.4.1 of the Draft RIA, EPA admits that some capital costs associated with equipment are not included in the vendor estimates and does not include general off-site costs, and that we adjusted for this by increasing capital costs by 15 percent and added an additional 3 percent for start-up. However, they believe, these adjustments are far below acceptable engineering practices for cost estimation. They cited a study by the National Petroleum Council, which used a factor of 40 percent to account for off-site costs, and a MathPro study, which used a factor of 50 percent. Therefore, the commenters believe that we underestimated the cost of hydrotreating by the conventional and advanced technologies.

<u>Letters:</u>
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 37
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 33

Our Response:

As mentioned in API's and NPRA's comments, we increased capital costs by 18% to account for costs which are not included in either vendor's estimates, nor in the general off-site factors. One example would be greater piping costs due to less than optimum locations of process units, the sulfur plant, etc. Another example would be intermediate tankage to smooth out variations in the quality of distillate feedstock prior to hydrotreating, or improved control of the production of light cycle oil and light coker gas oil. Another example would be expansions of the sulfur plant to handle the additional sulfur removed from NRLM fuel, a new sulfur analyzer etc.[32] Additionally, there are other capital costs that occur due to unpredictable events, such as material and product price changes, cost data inaccuracies, errors in estimation, and other unforseen expenses. In the NPRM, we accounted for these costs, by increasing the capital costs (after off-sites adjustment) by 18%. As summarized above, API and NPRA suggest that a much larger factor should have been used.

We have used a factor of 15% in several past rulemaking analyses, such as those for the Tier 2 gasoline sulfur standards and the 15 ppm highway diesel fuel cap.[19, 20] We increased this factor to 18% when developing NRLM fuel costs in the NPRM to more clearly account for startup costs.

One factor that differs between the NRLM fuel program and these previous two sulfur control programs is the amount of sulfur being removed per gallon of fuel. In the previous two programs, both fuels contained roughly 300-350 ppm sulfur prior to further control. However, NRLM fuel currently contains 3100 ppm on average. In all cases, the final sulfur standards required sulfur to be reduced to 7-30 ppm. Therefore, on a per gallon basis, roughly ten times as much sulfur is being removed with the NRLM program than the previous two programs. Thus, the per gallon cost of sulfur plant expansions will be ten times greater. In addition, published capacities for refineries' process units indicates that some refineries currently producing high sulfur distillate do not have a sulfur plant. Thus, they would have to construct a new unit, which is generally more expensive than expanding an existing unit. Therefore, for the FRM, we considered it reasonable to more explicitly account for the cost of sulfur plant expansions in estimating the cost for this rule.

We considered two methods of including the cost of sulfur plant expansions for the FRM. One method was to estimate this cost on a refinery specific basis. Sulfur plant costs are subject to economies of scale like hydrotreaters. Thus, the amortized cost of the sulfur plant on a per gallon will vary depending on the volume of NRLM fuel being treated. Also, as described below in section 7.2.1.3.2, both sulfur level and the fraction of NRLM diesel fuel not already hydrotreated to 350 ppm sulfur varies significantly by PADD. (While these values likely vary further by refinery, but we lack the data to estimate these values on a refinery specific basis.) These factors will also affect the cost of sulfur plant expansions. Finally, a few refiners do not currently have a sulfur plant. Thus, they would actually be building a new grass-roots plant, rather than expanding an existing plant. Thus, their costs will differ.

The other method considered was to increase the previous 18% contingency factor to account for the cost of sulfur plant expansion for a typical refinery and apply this new contingency factor to all refiners. While less precise, sulfur plant costs are small compared to that of the new or revamped desulfurization equipment, particularly for those refineries which already have a sulfur plant (the vast majority of refineries). Thus, variations between refiners are a small percentage of total capital costs and an even smaller percentage of total per gallon costs. Adjusting the capital contingency factor was also simpler to accomplish.

Given the relatively small cost of sulfur plant expansions, we decided to adjust the capital contingency factor for the FRM to represent the cost of a typical sulfur plant expansion with one

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[32] Sulfur is removed from a large number of process streams in a refinery, usually in the form of hydrogen sulfide. Hydrogen sulfide is a harmful gas. Thus, refiners convert this gas into elemental sulfur in the refinery's "sulfur plant".

improvement. We developed two sets of contingency factor adjustments, one for refineries with existing sulfur plants and one for refineries without an existing sulfur plant. This method reflects the factor having the greatest impact on sulfur plant costs, while still accounting for the sulfur plant costs within the contingency factor.

We first estimated the cost of building or expanding sulfur plant capacity associated with desulfurizing NRLM fuel from current sulfur levels to 500 ppm and from 500 ppm to15 ppm. The sulfur plant cost associated with desulfurizing NRLM fuel from current sulfur levels to 15 ppm was assumed to be the sum of these two steps. This likely over-estimated sulfur plant costs for the few refineries without existing sulfur plants, as the per unit capacity cost of the second sulfur plant is very high due its extremely small size. These refiners would likely build a single larger sulfur plant for the first step of NRLM sulfur control to take advantage of the economy of scale. However, very few refineries fall into this category and it was easier to apply the modified contingency factors in this way. We then converted these sulfur plant costs to a percentage of hydrotreater costs for both conventional and Process Dynamics technologies. (Both the hydrotreater and sulfur plant costs were estimated on an ISBL basis. Including off-sites would have increased both costs by the same factor, so the ratio of the two ISBL costs is the same as the ratio of the OSBL costs. It was simpler to eliminate the step of including off-site costs in both cases.) We then determined the portion of the previous contingency factor which represented the more modest sulfur plant costs required by the previous sulfur control programs. The additional sulfur plant cost required by the NRLM fuel program was then added to the previous contingency factor to create a new contingency factor which more appropriately considered sulfur plant costs.

Our estimate of the cost for expanded sulfur processing capacity was based on a typical U.S. refiner being affected by the NRLM rule. This hypothetical refiner was assumed to have a crude oil throughput of 128,000 BPSD and produce 25,000 BPSD of high sulfur distillate. The current sulfur content of the NRLM diesel fuel was assumed to be that of national average NRLM fuel, or 3100 ppm, as derived in Section 7.1 of the Final RIA. Its composition is 21.3% LCO, 9.4% cracked stocks with the remaining balance as straight run distillate, as described in section 7.2.1. of the Final RIA. We considered two cases. The first applied to refineries which already have a sulfur plant which can be debottlenecked (or revamped) to expand capacity. In this case, the baseline capacity was estimated to be 117 tons of sulfur per day. As will be seen below, the amount of sulfur removed due to NRLM fuel controls is roughly 10% of this baseline capacity, so the premise that the existing sulfur plant can be revamped is reasonable. The second applied to refineries which do not currently have a sulfur plant and a new plant would have to be built in order to produce lower sulfur NRLM fuel.

The sulfur plant is assumed to be comprised of an amine unit, a Claus sulfur recovery unit and a Scott unit. The capital costs for new units were obtained from Petroleum Refining.[21] We adjusted these costs from 1999 to 2002 dollars using the Chemical Engineering Cost Index [22]. The capital cost for debottlenecking an existing sulfur plant were assumed to be equal to the capital cost of a new unit on a per sulfur ton processed basis. In other words, if a 100 ton per day unit cost $10 million, then the per ton cost would be $100,000. If an additional 10 tons per day of capacity were needed, the expansion would cost $1 million. For new sulfur plants, the capital costs for units of various capacity were scaled using the "sixth tenths rule" using a scaling factor of 0.6 According to this rule, the capital cost of a process unit is proportional to the ratio of the unit capacity taken to "six-tenths" power.[33]

Table 6-1
Capital Cost of a Grass Roots 117 Ton per Day Sulfur Plant
(million 2002 dollars)

Amine Unit	10.5
Claus Sulfur Recovery Unit	10.5
Scott Unit	7.1
Total Sulfur Plant Cost	28.2
Total Sulfur Plant Cost per ton sulfur	0.241

The next step was determining the incremental sulfur plant capacity associated with the NRLM rule. As mentioned above, we assumed a starting sulfur level of 3100 ppm for NRLM fuel. As described in Chapter 7.1 of the Final RIA, we project that NRLM fuel meeting a sulfur cap of 500 ppm will average 350 ppm sulfur, while NRLM fuel meeting a sulfur cap of 15 ppm will average 11 ppm sulfur upon sale to the final purchaser. Assuming a diesel fuel density of 7.1 pounds per gallon, treating one gallon of diesel fuel from 3100 ppm to 350 ppm will remove 0.0195 pounds of sulfur. Treating one gallon of diesel fuel from 350 ppm to 7 ppm will remove 0.0024 pounds of sulfur.[34] For our hypothetical refinery producing 25,000 bpsd of NRLM fuel, additional sulfur plant capacity of 9.3 tons per day will be needed to meet the 500 ppm cap, while another 1.1 tons per day will be needed to meet a 15 ppm cap. Thus, a total of 10.4 tons per day would be removed when producing 15 ppm NRLM fuel. Since the step to 500 ppm removes roughly 90% of the eventual sulfur removed at 15 ppm, it is reasonable to assume that refiners would only revamp their existing sulfur plant (or build a new plant) once and size it for the full step to 15 ppm.

Applying the "six-tenths" rule, a new sulfur plant with a capacity of 10.4 tons per day will cost $7.9 million.[35] Assuming that an existing sulfur plant can be expanded at a cost proportional to the cost of the current 117 ton per day unit will cost much less, 2.5 million.[36] The difference exists because the construction of smaller units is more expensive per unit capacity than that of larger units. It is generally much less expensive to expand an existing unit's capacity by debottlenecking the equipment which limits capacity than to construct a small, grass roots unit. These figures are summarized in the following table.

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[33] Capital cost of a new sulfur plant with X ton per day capacity = (capital cost of a new sulfur plant with 117 tons per day capacity) * [(X / 117) ^ 0.6]

[34] We project that refiners will desufurize "15 ppm" diesel fuel to 7 ppm in order to ensure compliance during distribution. On average, we project that this 7 ppm level will increase to 11 ppm during distribution.

[35] $28.2 million * $(10.4/117)^{0.6}$

[36] $28.2 million * (10.4/117)

Table 6-2
Sulfur Plant Cost for a Hypothetical Refinery (Million 2002 Dollars)

	Uncontrolled Sulfur to 500 ppm	500 ppm to 15 ppm	Uncontrolled Sulfur to 15 ppm
New Sulfur Plant Capital	6.2	1.7	7.9
Debottleneck Sulfur Plant Capital	2.2	0.3	2.5

We next determined these sulfur plant costs as a percentage of hydrotreater costs excluding off-sites. The following table shows hydrotreater costs for the two technologies and the three sulfur steps. It also presents the above sulfur plants costs and the ratio of the sulfur plant to hydrotreater costs in percentage terms.

Table 6-3
NRLM Hydrotreater Capital, Sulfur Plant Capital and Capital Cost Contingency Factors

	Hydrotreater Cost ($ million)	Sulfur Plant Cost ($ million)		Sulfur Plant Cost (% of Hydrotreater Cost)	
		Revamp	New	Revamp	New
NRLM fuel Desulfurized from Uncontrolled Sulfur to 500 ppm Standard					
Conventional - New Unit	16.8	2.2	6.2	13	37
Process Dynamics - New Unit	11.6	2.2	6.2	18	53
NRLM fuel Desulfurized from Uncontrolled Sulfur to 15 ppm Standard					
Conventional - New Unit	34.8	2.5	7.9	6	22
Process Dynamics - New Unit	23.2	2.5	7.9	10	33
NRLM fuel Desulfurized from 500ppm to 15 ppm Standard					
Conventional - Revamp Unit	18.0	0.3	1.7	2	9
Conventional- New Unit *	34.8	0.3	1.7	1	5
Process Dynamics - Revamp Unit	11.6	0.3	1.7	2	15

* Current highway hydrotreater is used to produce 500 ppm NRLM fuel, but sulfur plant still needs to be expanded.

As shown in the above table, the cost of the sulfur plant for the step from 500 ppm to 15 ppm when the refiner already has a sulfur plant is only 2.6%. This is the situation faced by the vast majority of refiners who produce highway diesel fuel. In estimating the cost of the 15 ppm cap for highway diesel fuel, we used a capital cost contingency factor of 15%. We believe that this factor was sufficiently large to include the cost of the sulfur plant expansion, as well as other costs. Thus, in determining how to include a larger sulfur plant cost for this NRLM rule, we assumed that the 18% contingency factor used in the NPRM analysis already included 2.6% for sulfur plant costs. Thus, we deducted 2.6% from the percentages in the above table when increasing the contingency factor to represent higher sulfur plant costs. The final contingency factors are shown below.

Table 6-4
Final Capital Cost Contingency Factors (% of Hydrotreater Costs Including Off-Sites)

	Capital Contingency Factor for Debottleneck Sulfur Plant	Capital Contingency Factor for New Sulfur Plant
NRLM fuel Desulfurized from Uncontrolled Sulfur to 500 ppm Standard		
Conventional - New Unit	29	53
Process Dynamics - New Unit	34	69
NRLM fuel Desulfurized from Uncontrolled Sulfur to 15 ppm Standard		
Conventional - New Unit	22	38
Process Dynamics - New Unit	26	49
NRLM fuel Desulfurized from 500ppm to 15 ppm Standard		
Conventional - Revamped Unit	18	25
Conventional - New Unit *	17	21
Process Dynamics - Revamp Unit	18	31

* Current highway hydrotreater was used to produce 500 ppm NRLM Fuel

We applied the above contingency factors to each refinery depending on whether or not it had an existing sulfur plant. We obtained this information from the 2002 EIA Petroleum Supply Annual.

The addition of the sulfur plant costs increases our previous capital contingency factor of 18% significantly in most cases. In some cases, this factor falls within and even exceeds the 40-50% range suggested by API. As API offered no further support for the contingency factors used by the National Petroleum Council and Mathpro, we believe that the more explicit treatment of sulfur plant costs described above is preferable.

While the focus of this section is capital cost, in the process of evaluating the capital cost of sulfur plants, we also reviewed their cost of operation. The fixed operating cost of the additional sulfur plant work are captured in our analysis due to how we estimate fixed cost as being a percentage of the total NRLM capital costs (adjusted for offsite factor, location factor and contingency factor), see section 7.2.1.4.2. However, variable operating cost for sulfur plants are very small. Sulfur plants have low energy requirements, since they generate excess steam from burning the sour gas feed. This steam has economic value and offsets most of the other operating costs. Thus, there was no need to modify our contingency factor for operating costs (section 7.2.1.4.5) to better account for the additional costs of operating expanded sulfur plant capacity. While most refiners receive some economic benefit from selling the extracted sulfur on the open market, the amount of sulfur being removed from crude oil is approaching or in some places already exceeding the demand for sulfur. Thus, we did not assume any market value for the incremental sulfur being produced as a result of the NRLM rule.

6.2.1.3 Penetration of Advanced Desulfurization Technologies

What Commenters Said:

EPA uses a technology mix of 60 percent conventional and 40 percent advanced technologies for 2008, which is consistent with the NPC assumptions. However, the NPC study assumed that by this time, advanced technologies would have been commercially demonstrated, which is not the case. Advanced technologies are likely to represent much less than 40 percent, given that both of the advanced technology concepts espoused by EPA still have not been demonstrated commercially. It is unlikely that a significant number of refineries will risk the uncertainties associated with these advanced technologies. EPA should assign a risk factor to the advanced desulfurization technologies to compensate for the unknown additions to the capital costs. An appropriate risk adjustment in this case would be 40 percent for capital costs and 30 percent for operating costs.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 37
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 33

Our Response:

One of the most promising new desulfurization technologies is Process Dynamics IsoTherming, which has already been commercially demonstrated. Process Dynamics, working with Linde Process Plants for engineering support, built a commercial-sized demonstration unit (5000 barrels per day) at a refinery in New Mexico and has been operating the equipment since September 2002, demonstrating the capability to meet 15 ppm since the spring of 2003. Thus, refiners will have 4-5 years of operating data available on this process before they would have to decide which technology to use to meet the 15 ppm NR sulfur cap in 2010. This should be ample operating experience for essentially all refiners to include this process in their options for 2010. Based on information received from Process Dynamics, we estimate that this technology could reduce the cost of meeting the 15 ppm cap for many refiners by about 20 percent. The cost savings for Process Dynamics IsoTherming primarily arises from the smaller reactor volume required and other avoided capital costs (recycle gas compressor and reactor distributer). These lower capital costs also translates into lower fixed and variable operating costs, such as less catalyst. Refineries which tend toward higher capital costs on a per-barrel basis, such as small refineries, are particularly benefitted by the Process Dynamics process. The commercial experience and cost savings of the Process Dynamics IsoTherming desulfurization technology makes it a prime contender in the desulfurization market.

Given the commercial demonstration of the Process Dynamics technology, we do not believe that the large risk factors suggested by API and Marathon are merited. In fact, we have already increased our cost estimates for the Process Dynamics technology relative to the NPRM. This was done to reflect improved cost estimates available from Linde based on the actual commercial operation of the demonstration unit. The previous estimates were based only on pilot plant data.

6.2.1.4 Natural Gas and Hydrogen Costs

What Commenters Said:

In Table 7.2-26, to estimate the hydrogen production cost, a natural gas cost of $2.75/mmBtu was used. This is no longer valid and the current natural gas price is in the range of $4.50 to $6.00/mmBtu and is projected by EIA to remain in this range for the foreseeable future. This could increase projected hydrogen costs by at least 50 percent, which would increase EPA's cost estimates for ultra-low sulfur diesel by 1 to 1.5 cents per gallon.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 37

Marathon Ashland, OAR-2003-0012-0826, 0827 p. 33

Our Response:

In the NPRM, future natural gas prices were based on the average natural gas price from 1996 to 2001. Natural gas prices varied widely during this time, and we used this average to dampen out this price variability. There was also some question concerning whether the substantial increase in natural gas prices seen since 2000 would continue into the future.

It now seems clear that natural gas will be in relatively short supply for the foreseeable future and that higher prices compared to those seen during the 1990's will be typical. Thus, for the final rule, we decided to base future natural gas prices on those contained in EIA's 2003 Annual Energy Outlook. This natural gas price was $4.15 per mmBtu, representing a 50% increase of that used in the Draft RIA.

6.2.1.5 Hydrogen Consumption Associated with Desulfurization Technologies

What Commenters Said:

It is difficult to estimate the hydrogen consumption for the advanced technologies with any degree of accuracy although correlations may exist. For a 100 SCFB change in hydrogen consumption, the operating costs will change by about 1 cent per gallon. Hydrogen consumption in the range of 360 to 375 SCFB has been referenced for the various technologies both for revamp and grass roots options. However, if cracked stocks are present in the feed this number will rise into the thousand SCFB range. EPA has assumed a low hydrogen consumption value based on the assumption that all non-desulfurization reactions that use hydrogen can be eliminated. However, in the real world, this optimistic projection cannot be achieved.

In addition, EPA has continued to base its design case on average HDS feed properties, but each refinery must base its HDS design on the worst possible HDS feed it will have to process. Refiners need to account for additional HDS capability to ensure that the target sulfur specification is achieved. EPA has failed to recognize this in its cost estimates.

<u>Letters:</u>
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 37-38
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 33-34

Our Response:

In the NPRM analysis, we did not assume that all non-desulfurization reactions could be eliminated. We based our estimates of hydrogen consumption on vendors' estimates which included both desulfurization and other reactions. Contrary to API's assertion, most of the hydrogen consumed in reducing NRLM fuel sulfur levels from 500 to 15 ppm in our analysis was unrelated to desulfurization and due to saturation of aromatic rings and the breaking of these rings. This is evidenced by the difference in hydrogen consumption projected for the four blendstock types. For example, the hydrogen consumption for reducing LCO sulfur levels from 500 to 15 ppm are 4 times greater than those for straight run, when the volume of hydrogen needed to actually combine with the sulfur in both of these blendstocks is the same.

We base each refinery's hydrogen consumption on its average blendstock properties. However, the average hydrogen consumption should in fact be related to the average blendstock properties. The desulfurization equipment itself may have to be designed to handle a worse than average blendstock composition, as the blendstock composition presumably varies seasonally, as well as daily. Thus, our capital cost estimates should account for this variability, but the hydrogen consumption estimates do not need to. Lower than average hydrogen consumptions will occur with better than average blendstock compositions, which will balance higher than average hydrogen consumptions associated with worse than average compositions.

Regarding our estimate of capital costs, we assumed that hydrotreaters would only be designed to operate at 80% of capacity, when they normally operate at 90% of capacity. This provided a 10% safety factor for variability in blendstock composition.

6.2.1.6 Technical Feasibility of Producing 7 ppm Diesel Fuel

What Commenters Said:

The reactions and kinetics of ultra-low sulfur diesel are not as straight-forward as EPA indicates. The low level of the design target (7 ppm) requires the reactor to perform ideally and continuously and even under these assumptions, many sulfur species will fail to react with hydrogen. The recalcitrant sulfur molecules such as the 4,6-DMDBT may be present in such a quantity that the residence time and catalyst volume required to remove them would not be cost-effective. In addition, the "sulfur floor" or the lowest level of sulfur that can be achieved cannot be reduced further through increasing the reactor temperature. There is no commercial desulfurization unit aside from hydrocracking that can produce ultra-low sulfur diesel on a continuous and economical basis.

Minimizing problems with flow will depend in part on the internal system, such as the proper design of distributors and bypass tubes, the choice of optimum mass velocity, and the careful loading of catalyst. These factors are critical and there is almost no margin for error. Heat exchanger leaks, process upsets, and inadvertent refinery sulfur contamination, will immediately result in off-specification fuel. Reprocessing this off-spec fuel is costly since it will most likely involve backing down of crude and FCC operational rates.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 38
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 34

Our Response:

All of the factors mentioned by API and Marathon-Ashland are important to the proper design of equipment producing 15 ppm highway or NRLM fuel. We have included the cost of improved distributors, heat exchangers and other ancillary items associated with successful diesel fuel hydrotreating in our cost estimates. The presence of sterically hindered sulfur molecules such as 4,6-DMDBT will certainly factor into each refiner's plans for both the type of desulfurization equipment which they need and the volume of 15 ppm diesel fuel which they believe that they can produce economically. For catalyst type and hydrogen pressure, there can be a "floor" below which sulfur cannot be effectively reduced. However, refiners can design their units for a higher hydrogen pressure and take advantage of more advanced catalysts. By saturating the aromatic rings contained in these sterically hindered compounds, they can remove the steric hindrance and ease sulfur removal. For the NPRM, we basically assumed that all new 15 ppm NRLM fuel produced in response to this rule will be produced using new desulfurization equipment. Thus, refiners have the flexibility to design this equipment to address the diesel fuel blendstock compositions which they anticipate producing from their future crude oils. Under these conditions, there is no evidence of a "floor" sulfur level.

API and Marathon-Ashland also fail to note that the advanced Process Dynamics IsoTherming process has been producing 15 ppm diesel fuel from typical diesel blendstocks since the spring of 2003. Numerous other refiners have been using their existing hydrotreaters to experiment with catalysts and operating conditions to determine the combination of factors which will be needed to produce 7 ppm diesel fuel.

6.2.2 The Initial Volumes of Ultra-low Sulfur Diesel Will Be the Most Cost-effective to Produce

What Commenters Said:

The initial volumes of 15 ppm highway diesel in 2006 are likely to be produced via revamps of existing hydrotreaters and tailored feedstock selection to exclude or minimize cracked stocks that are more difficult to treat. This implies some inherent reduction in the supply of highway diesel. When the remainder of the highway and all of the nonroad diesel must also be ultra-low sulfur diesel in 2010, the cost per barrel for treatment will increase, as those harder to treat fractions are re-introduced into the low-sulfur diesel pool

Letters:
ExxonMobil, OAR-2003-0012-0616 p. 19

Our Response:

Revamps of existing hydrotreaters to produce 15 ppm fuel can be done in a way that throughput is reduced, but they can also be done to maintain or even increase production. We base our projection of future 15 ppm highway diesel fuel production on refiners' own pre-compliance reports, which will reflect their specific plans to modify or build new hydrotreaters. These pre-compliance reports do not indicate a reduction in highway diesel fuel supply. However, our analysis in Section 7.2.1.3 of the Final RIA indicates that these reports show that the projected production of 15 ppm highway diesel fuel in PADDs 4 and 5 could be less than demand. In these areas, we project that a small number of additional refineries will invest to produce 15 ppm highway diesel fuel. In contrast, there is a much larger over-supply of 15 ppm highway diesel fuel in PADD 3.

Regarding the relative cost of 15 ppm highway and NRLM fuel, we point out in Section 7.2.2 of the Final RIA four reasons why the cost of producing 15 ppm diesel fuel under the 2007 highway rule should be lower than that under this NRLM fuel rule. One of these reasons is that refiners are likely to shift hydrocrackate to the highway fuel pool. However, we also point out at least one reason why costs for 15 ppm NRLM fuel could be lower than 15 ppm highway fuel. That is the use of advanced desulfurization technology which is already being commercially demonstrated. Overall, our cost estimates show that the factors tend to offset each other, with the result that we project very similar costs for 15 ppm highway and NRLM fuel.

6.3 Costs of Distributing Nonroad Diesel Fuel

6.3.1 Fungible Shipment of 500 ppm Highway and NRLM Fuel

What Commenters Said:

If EPA provides a method to allow for the fungible shipment of highway and nonroad 500 ppm diesel, the incremental costs associated with additional storage and delivery would be significantly less.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 39
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 35

Our Response:

In designing the final NRLM fuel program, we made it a high priority to facilitate the fungible shipment of 500 ppm highway and NRLM fuel. The designate and track method now included in the final rule should eliminate any need to segregate shipments of highway and NRLM fuel meeting the same sulfur standard.

6.3.2 Tank Truck Costs

What Commenters Said:

The assumptions and calculations made by EPA in characterizing costs for bulk plant operators seem reasonable. However, EPA's assumption that a single tank truck would service a bulk plant is probably not accurate. The number is likely to be much greater, which would increase EPA's cost estimate slightly.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 38
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 34

Our Response:

We agree that a single truck might not be sufficient to handle all the fuel from a single bulk plant. Therefore, we have assumed that affected bulk plant operators will demanifold an average of three delivery trucks so that it can transport multiple products, and have included costs for these steps (see Section 7.4.1 of the Final RIA).

6.3.3 Handling of 15 ppm Fuel Downgraded During Distribution

What Commenters Said:

Even though it is possible that the investments made to meet the highway diesel requirements will minimize additional distribution costs, it is likely that some of the pipelines and terminals will need to build extra capacity to handle downgrades of 15 ppm NRLM or for handling transmix or interface volumes.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 39
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 35

Our Response:

As described in the Draft RIA, we agree that the combination of controlling highway and nonroad fuel to 15 ppm will eliminate the regular shipment of higher sulfur diesel fuel and heating oil from many pipelines. Our decision to control L&M fuel to 15 ppm increases this probability, as this action decreases the volume of distillate not meeting a 15 ppm cap. Our estimates of the volume of 15 ppm fuel needing to be produced and distributed to the final user reflect this assumption.

The absence of high sulfur heating oil in the pipeline will also necessitate segregating the interface between jet fuel and 15 ppm diesel fuel from those pipelines not carrying heating oil. This interface will not meet either jet fuel or 15 ppm diesel fuel specifications and, thus, cannot be simply cut into either batch. Section 7.1 of the Final RIA now contains a detailed analysis of the volumes of this interface produced in each PADD and its disposition to markets allowed to use this fuel. One of the new components of the final rule is to allow the use of 500 ppm fuel created in the distribution system in locomotive and marine diesel engines, outside of the Northeast/Mid-Atlantic Area and Alaska.

It is possible that this interface could be stored in tankage previously used to store 500 ppm NRLM fuel during 2007-2010. However, the additional inventory required to handle demand for 15 ppm highway and NRLM fuel might require that this tankage be used to supplement previous 15 ppm storage capacity. Thus, we have assumed that most terminals and transmix processors will have to add storage tankage for this interface. We also believe that there could be additional trucking costs to distribute this transmix distillate to the locomotive, marine and heating oil markets. Our analysis of distribution costs in Section 7.4 of the Final RIA has been modified to include these costs.

6.4 Fuel Marker Costs

6.4.1 Distribution of Marked Fuel

What Commenters Said:

EPA's proposed approach for the distribution of marked fuel will be costly for refiners and consumers. Refiners must make a large capital investment in order to distribute marked fuel. Some have indicated that the costs may approach $250,000 per facility. Therefore, any terminal that chooses to make this investment will have a substantial stake in distributing a high sulfur product into the future and may seek to continue in that business through aggressive pricing or other marketing schemes to ensure that the marked product has a role. The commenter (NORA) noted that this could delay their voluntary efforts to convert the heating oil pool to a 500 ppm fuel.

Letters:
National Oilheat Research Alliance, OAR-2003-0012-0840 p. 2

The National Oilheat Research Alliance commented that the cost of the marker ($0.002) will translate into a cost of nearly $20 million per year to heating oil customers. *(See additional discussion below on the variability of the overall cost of a fuel marker system in each PADD).*

Letters:
National Oilheat Research Alliance, OAR-2003-0012-0840 p. 1

Our Response:

The final NRLM fuel program includes a number of modifications that dramatically reduce the cost and burden associated with marking heating oil. The final rule exempts No. 2 fuel oil sold in most of the Northeast and Mid-Atlantic states and Alaska from the marker requirement, thereby reducing the potential marker costs by roughly 90%. In addition, we do not expect that high sulfur heating oil will be produced and distributed through pipelines outside of those serving the Northeast. The only heating oil sold outside the Northeast, Mid-Atlantic and Alaska will be that marketed directly from refinery racks and contaminated jet fuel and 15 ppm diesel fuel sold from terminals. Thus, today's rule minimizes the number of facilities that will need to install injection equipment for the heating oil marker (see Chapter 7 in the Final RIA). Most of the contaminated 15 ppm and 15 ppm diesel fuel should contain less than 500 ppm sulfur and can be sold to the locomotive, marine or heating oil markets. If it should contain more than 500 ppm sulfur, it can be sold to the heating oil market. The concerns regarding the potential that the NRLM rule may inhibit voluntary efforts to reduce heating oil sulfur to 500 ppm or less pertained to the installation of marker injection equipment at terminals. NORA stated that if terminals invested in such equipment, they would be motivated to continue selling high sulfur heating oil in order to recoup their investment. Since today's rule exempts the Northeast and Mid-Atlantic states from the marker requirement and we expect there will be only limited volumes of high sulfur heating oil outside of the this area, we do not expect that today's rule will delay their voluntary efforts to convert the heating oil pool to a 500 ppm fuel. To the contrary, we expect that today's rule increase the volume of spillover of low-sulfur fuels (NRLM fuel meeting the sulfur standards in today's rule and highway diesel fuel) that is used for heating purposes.

It should also be noted that we have continued to investigate the cost of the marker itself since issuance of the NPRM. More recent information indicates that the per gallon cost of the marker will be dramatically lower than that assumed in the NPRM. Thus, not only will the volume of heating oil being marked decrease dramatically, but the cost per gallon for the remaining volume will decrease, as well.

6.4.2 Geographic Issues

What Commenters Said:

NORA commented that the cost of the proposed marking and credit trading program is disproportionately high in PADD I. They further stated that limiting the credit trading program to PADDs II through V will eliminate nearly all costs on the heating oil sector, and may not impose any limits on the use of the credit trading program. EIA statistics indicate that the costs of the program as currently proposed are much higher in PADD I, particularly for heating oil consumers. For example, EIA statistics indicate that in sub-PADD 1A, approximately 2.7 billion gallons of heating oil are consumed annually and given a marginal cost for the marker of $0.002, this leads to an annual cost to heating oil consumers of $5.4 million per year. There are approximately 100 terminals in this region that handle heating oil and assuming a marginal cost of $25,000 per terminal for equipment installation, capital costs and computer programming, the cost of the marker program would be $2.5 million or $800,000 annually for the three years of the program. Therefore, the heating oil customer would bear a total cost of $6.2 million per year. Marking the heating oil in this sub-PADD would allow for an ABT program of 156 million gallons resulting in a cost of $0.04 per gallon for the refiner. This is a disproportionate cost that only provides potential flexibility in one market. NORA provided additional discussion on this issue, EIA data on fuel use within each PADD, and an analysis comparing the costs in the entire PADD I area (which are similar to sub-PADD 1A) with the costs in PADDs II through V. Based on these data, this commenter concludes that EPA should not establish a marking system (and thus no ABT program) in any PADD where the ratio of heating fuel to off-road fuels exceeds one, and that by not requiring heating oil to be marked in PADD 1, the marginal cost of marking heating oil would be eliminated, reducing the cost of the rule by nearly $11 million per year. *(See related discussion under Issue 10.3.6)*

Letters:
National Oilheat Research Alliance, OAR-2003-0012-0840 p. 3-5

Our Response:

The final rule adopts provisions very similar to those outlined in NORA's comments. The final NRLM fuel program exempts No. 2 fuel oil sold in most of the Northeast and Mid-Atlantic states and Alaska from the marker requirement, thereby reducing marker costs by roughly 90%. As discussed in Section 5.5 of the Final RIA, we designed the program to maximize refiner flexibility, while at the same time eliminating the marker requirement for the vast majority of the heating oil market.

7. BENEFITS METHOD AND ENVIRONMENTAL IMPACT ANALYSIS

7.1 Benefits Method

7.1.1 Ozone, CO, and Air Toxics Should Be Considered

What Commenters Said:

NRDC and STAPPA/ALAPCO commented that EPA would be able to show even higher net benefits for the rule if we performed additional air quality modeling or quantification of the benefits associated with reductions in ozone, CO, and air toxics since these benefits are likely to be significant. Commenter provides no additional discussion or supporting documentation.

Letters:
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 13
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 8

Our Response:

We agree that in our economic benefits assessment, we have omitted important benefits categories from our quantified results, including ozone, CO, and air toxics. However, we included analysis of health benefits stemming for ozone reductions resulting from the preliminary control option for the proposal for the rule.

Regarding CO, modeling of health effects associated with this constituent requires highly spatially-refined exposure modeling that currently is not supported at the national-scale. The Agency agrees with the commentator that inclusion of health benefits resulting from CO reductions would further increase the net benefits associated with the rule. Regarding air toxics, it is likely that the epidemiologically-derived effects estimates for $PM_{2.5}$ capture some of the constituent-specific cancer incidence resulting from individual HAPs contained in diesel exhaust. It is also likely that if cancer incidence for individuals HAPs was modeled, the aggregate incidence across HAPs would be lower than estimates generated using the PM effects estimate, since the latter includes consideration for interactions between carcinogens (e.g., synergistic interactions), while modeling of individual HAP-related cancer risk would not. There are additional limitations to modeling cancer incidence for individual HAPs, including the fact that the unit risk factors developed for HAPs are largely based on animal toxicity data which introduces significant uncertainty into the generation of representative population cancer estimates for human receptors.

7.1.2 Uncertainties Associated with the Health Benefits Methodology

7.1.2.1 Studies Used

What Commenters Said:

API and Marathon commented that they believe that there are numerous uncertainties associated with the methodology used to estimate health benefits. There are several factors that contribute to the uncertainty in EPA's health benefits analysis. The vast majority of the estimated benefits (92 percent in the base estimate) stem from reduced mortality due to a reduction in $PM_{2.5}$ concentrations. EPA relies on studies such as Harvard Six Cities and American Cancer Society (ACS) Studies to establish and quantify the long term relationship between $PM_{2.5}$ and health impacts. However, according to the White House Office of Science and Technology Policy the $PM_{2.5}$ database is poor, and current data do not support clear associations. In addition, the studies cited by EPA fail to adequately assess the potential impacts of cofactors such as ozone or SO_2. Further illustrating the inherent uncertainty in EPA's benefit estimates is the fact that EPA's Health Assessment Document for diesel engine exhaust (EPA 6000/8-90/057F) does not provide an adequate uncertainty analysis for use in risk assessment and rulemaking. Given the large amount of uncertainty surrounding $PM_{2.5}$ concentrations and health impacts, it follows that very significant uncertainty surrounds the benefit estimates as well. This uncertainty should be quantified. (See related discussion below and under Issue 7.2)

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 49-50
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 45-46

Our Response:

The Agency recognizes that estimates of PM-related health effects are subject to uncertainty related to different steps of the analytical (modeling) process. In response to comments from both the NAS and the SAB’s Health Effects Subcommittee (SAB-HES), as well as various commenters, we have initiated the development of an integrated strategy to characterize uncertainty in its benefits estimates, including uncertainty associated with the effects estimates for key endpoints including mortality. This approach will consider the entire analytical framework used in quantifying benefits and will focus in on those elements that contribute most significantly to uncertainty in those estimates. As soon as elements of this strategy are finalized, we will apply them in order to characterize uncertainty in our benefits estimates. It is also important to note that, while the NAS highlighted the need for quantitative characterization of uncertainty associated with benefits estimates, it also stated that the presence of uncertainty in benefits estimates should not delay action taken to promote or protect public health.

Specifically regarding the strength of the association between PM exposure and mortality, reflecting recommendations from the SAB-HES, we have updated our benefits methodology to utilize the Pope 2002 reanalysis of the ACS data. The Pope 2002 reanalysis incorporates several enhancements that strengthen conclusions regarding the association between long term exposure to $PM_{2.5}$ and mortality and increases our ability to examine the potential for effects modification by a range of possible risk factors including those mentioned by the commenter (e.g., educational status, age, smoking status). These enhancements include: (a) addition of 8 years of follow-up data with an increase in number of deaths, (b) inclusion of range of dietary covariates in modeling, (c) improvements in treatment of occupational exposure and (d) refinements in methods used to address potential spatial autocorrelation in ecologic variables.

Regarding the specific issue of potential confounding by SO_2 and ozone, the HEI reanalysis of the ACS study data, as well as other studies examining the SO_2 copollutant issue (Samet et al., 2000, 2001) have suggested that SO_2 might represent a surrogate for ambient $PM_{2.5}$ concentrations and is likely associated with sulfate concentrations since it is a precursor. This could partially explain the association between SO_2 and mortality found in the HEI reanalysis of the ACS study data. As mentioned above, we have updated our methods for characterizing mortality and are now using the Pope 2002 reanalysis of the ACS study data. While this study continues to find and association between SO_2 and cardiovascular mortality, it also finds the strongest association yet between long term $PM_{2.5}$ exposure and mortality.

Regarding ozone as a potential copollutant for PM, the SAB-HES in its review of the analytical framework used in this benefits analysis suggested that, where possible, effects estimates could be based on relative risk ratios obtained from two-pollutant models (PM and ozone). This allows estimates for the one constituent to be adjusted for the other (e.g., PM effects estimates to control for ozone impacts). However, the SAB-HES also notes that PM and ozone are the least spatially correlated of the criteria pollutants and therefore, it is not critical that PM effects estimates that control for ozone (and vice versa) be used in benefits analysis.

7.1.2.2 Value of a Statistical Life

What Commenters Said:

API and Marathon commented that EPA's estimates of the value of a statistic life (VSL) adds another level of uncertainty to the benefit estimates. EPA's estimate of VSL is based on the mean VSL estimates from 26 studies that may or may not be appropriate for use with the populations impacted by this proposed rule. Even though EPA states their preference not to assign monetary value to lives saved, the sensitivity case does just that. Given the uncertainty associated with the relationship between VSL and age, and the potential for misunderstanding of the use of this type of analysis, more research is needed in the derivation of a defensible base estimate for the value of a statistical life. EPA's $6.3 million VSL estimate does not accurately reflect the risk preferences of the target population and is not appropriate for use in the valuations of reduced mortality. This is a critical point since this parameter is a major driver in the benefit estimation in the RIA.

<u>Letters:</u>
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 50-51
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 47

Our Response:

EPA agrees that there is a large amount of uncertainty in the VSL for application to environmental policy analysis. However, as noted in the RIA, the SAB Environmental Economics Advisory Committee has advised that the EPA "continue to use a wage-risk-based VSL as its primary estimate, including appropriate sensitivity analyses to reflect the uncertainty of these estimates," and that "the only risk characteristic for which adjustments to the VSL can be made is the timing of the risk"(EPA-SAB-EEAC-00-013, U.S. EPA, 2000b).

In response to concerns about the range of estimates included in the VSL distribution, we have modified the value of life distribution. The mean value of avoiding one statistical death is now assumed to be $5.5 million in 1999 dollars. This represents a central value consistent with the range of values suggested by recent meta-analyses of the wage-risk VSL literature. The distribution of VSL is characterized by a confidence interval from $1 to $10 million, based on two meta-analyses of the wage-risk VSL literature. The $1 million lower confidence limit represents the lower end of the interquartile range from the Mrozek and Taylor (2000) meta-analysis. The $10 million upper confidence limit represents the upper end of the interquartile range from the Viscusi and Aldy (2003) meta-analysis.

In developing our estimate of the benefits of premature mortality reductions, we have discounted over the lag period between exposure and premature mortality. However, in accordance with the SAB advice, we use the VSL in our primary estimate. Consistent with the SAB advice and In accordance with the provisions contained in the FY04 Appropriations bill, we do not adjust the VSL to reflect any differences across age groups.

7.1.2.3 Lag Structure

What Commenters Said:

Marathon and API commented that our assumed five-year lag structure between premature mortality and a given change in PM exposure with 25 percent and 16.7 percent of premature deaths occurring in the first and second years and in each of the remaining three years, respectively, is not supported by any scientific literature on PM-related mortality.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 51
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 47

Our Response:

As noted in the RIA Chapter 9, the size of the delay between changes in chronic PM exposures and changes in mortality rates is an important parameter in the benefits analysis. The size of such a time lag is important for the valuation of premature mortality incidences as economic theory suggests benefits occurring in the future should be discounted relative to benefits occurring today. Although there is no specific scientific evidence of the size of a PM effects lag, current scientific literature on adverse health effects associated with smoking and the difference in the effect size between chronic exposure studies and daily mortality studies suggest that all incidences of premature mortality reduction associated with a given incremental change in PM exposure would not occur in the same year as the exposure reduction. This literature implies that lags of a few years or longer are plausible. For our current analysis, based on previous advice from the SAB (EPA-SAB-COUNCIL-ADV-00-001, 1999), we have assumed a five-year distributed lag structure, with 25 percent of premature deaths occurring in the first year, another 25 percent in the second year, and 16.7 percent in each of the remaining three years. To account for the preferences of individuals for current risk reductions relative to future risk reductions, we discount the value of avoided premature mortalities occurring beyond the analytical year (2020 or 2030) using three and seven percent discount rates.

A more recent SAB-HES report confirmed the NAS (2002) conclusion that there is little justification for the 5-year time course used by EPA in its past assessments, and it suggested that future assessments more fully and explicitly account for the uncertainty. The SAB-HES suggests that appropriate lag structures may be developed based on the distribution of cause-specific deaths within the overall all-cause estimate.

The SAB-HES specifically noted understanding mechanisms of damage and developing models for different cause of death categories may be the key to characterizing more appropriate cessation lag functions. They note that our current understanding of mechanisms suggests there are likely short-term (e.g., less than six months for some cardiovascular effects), medium term (e.g., 2-5 years for COPD), and longer term (e.g., 15 to 25 years for lung cancer). They noted that there is a current lack of direct data to specify a lag function and recommended that information on the lag function be considered in future expert elicitations and/or sensitivity analyses. While we are working to develop the underlying data to support a more appropriate segmented lag structure, for the analysis in Chapter 9 of the RIA we maintained the 5-year lag structure used in the benefits analysis for the proposed rule. We have added an additional sensitivity analysis to Appendix 9C examining the impact of assuming a segmented lag of the type suggested by the SAB-HES. The overall impact of moving from the 5-year distributed lag to a segmented lag is relatively modest, reducing benefits by approximately 8 percent when a three percent discount rate is used and 22 percent when a seven percent discount rate is used. The agency is evaluating techniques for characterizing lag structures and will incorporate new methods as they become available.

7.1.2.4 Uncertainties in Emission Reduction Impact on Economic Benefits

What Commenters Said:

API and Marathon commented that to assess the uncertainty in emissions associated with the proposed rule, EPA arbitrarily assumed a plus or minus five percent change in the amount of emission reduction produced by the proposed rule. No basis exists to support this assumption. This approach is representative of how EPA has addressed the uncertainty associated with the benefits estimates and adds no value to the analysis since it is based on arbitrary assumptions without supporting evidence.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 51
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 48

Our Response:

We have removed the 5 percent change in emission reduction from the final rule. We have added a more thorough discussion of uncertainties related to fuel usage in appendix 8A.

7.1.2.5 Methodology to Compute Benefits Over Time

What Commenters Said:

API and Marathon commented that the methodology to compute benefits over time is based on unrealistic and unsupportable assumptions. EPA assumes no interactions between NO_x, SO_2 and direct PM in the formation of $PM_{2.5}$. The contribution to $PM_{2.5}$ of an increase in a particular species depends on emissions and concentrations of associated species including ammonia and those listed above. These non-linearities in atmospheric chemistry are not captured in the EPA analysis. As a result, EPA's benefit estimates appear to be linear, even though this is unlikely in reality. EPA also assumes that emission inventory shares remain constant across years, which is unlikely.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 52
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 48

Our Response:

The commenter is partially incorrect in the statement that "EPA assumes no interactions between NOx, SO_2, and direct PM in the formation of $PM_{2.5}$." In order to estimate benefits in years other than 2020 and 2030, it was necessary to interpolate values from 2020 and 2030. We used sophisticated air quality modeling (using the REMSAD model) to predict changes in ambient $PM_{2.5}$ in 2020 and 2030. This air quality modeling for 2020 and 2030 does incorporate the nonlinear interactions between NOx, SO_2, and direct PM. However, in order to develop the intertemporal scaling factors, we had to make some simplifying assumptions. We assumed that the interactions between SO_2 and NOx were linear over time, rather than assuming that there was no interaction. In other words, we assumed that the rate of change in the sulfate to SO_2, nitrate to NOx, and primary PM to direct PM ratios was a linear function of time. The rate of change is driven by differences in the baseline emissions between 2020 and 2030 and by differences in the ratio of NOx to SO_2 reductions from the nonroad sector. We verified the interpolation approach by predicting 2020 benefits using scaling factors for sulfate, nitrate, and direct PM based on the modeled 2030 benefits. Scaled benefits were within 4 percent of the actual modeled benefits for 2020. We thus are confident that the nonlinearities in sulfate and nitrate formation are adequately represented by our scaling factors.

7.1.2.6 Adjustment Factors for Willingness to Pay

What Commenters Said:

API and Marathon commented that the factors used to adjust current estimates of willingness to pay (WTP) for avoidance of adverse health incident are based on an incorrect methodology. EPA uses an adjustment factor of 1.09, 1.33, 1.29, and 1.79 to adjust for minor health effects, severe/chronic health effects, premature mortality, and recreational visibility, respectively, from 1990 to 2030. These were derived from cross-sectional data. However, income elasticities should be derived from time series data for use in this manner. The commenters stated that, given this and other concerns associated with the benefits methodology, EPA should re-estimate benefit streams and net present value estimates based upon defensible assumptions and an appropriate methodology.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 52
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 48

Our Response:

The method used to derive income adjustment factors is consistent with advice from the SAB-EEAC and reflect modest increases in WTP over time. Some recent evidence from published meta-analyses (see Viscusi and Aldy, 2003) suggest that EPA should be using a larger income adjustment factor for premature mortality.

7.1.2.7 Alternative Estimates

What Commenters Said:

API and Marathon commented that EPA's set of alternative estimates that postulate a short term daily relationship between $PM_{2.5}$ and premature mortality reduce the base benefit estimates. The Health Effects Institute has recently reported problems with the statistical methods used to estimate short-term exposure to air pollution and health effects. Researchers have found that standard errors associated with these estimates may be larger than originally reported and that reported health impacts may be biased upwards.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 52
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 48

Our Response:

Consistent with the recommendations from the SAB-HES and considering public comment, the Agency is no longer developing an alternative estimate based on mortality results generated using time-series study data. Instead, we are now using a primary estimate based on the Pope 2002 Re-analysis of the ACS study data, which is a long-term exposure cohort study.

7.1.3 Public Health Benefits Below the NAAQS

What Commenters Said:

Marathon and API commented that EPA cannot claim additional public health benefits for ozone and PM reductions in attainment areas. In the proposed rule, EPA implies that the public health impacts of emission reductions in attainment areas are counted as benefits, which is a questionable practice. This approach is contrary to the CAA, Section 211(c), which limits EPA's authority to regulate fuels to situations where emissions cause, or contribute to air pollution that may reasonably be anticipated to endanger public health or welfare. The NAAQS levels are set at a point to protect public health with an adequate margin of safety. Therefore, the public health benefits in non-transport attainment areas cannot be used to justify the proposed rule.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 42, 47, 51
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 43-44

Our Response:

We note that maintenance of the standards is an important reason for EPA’s programs, and these areas are by definition meeting the standards. In addition, because of the uncertainties inherent to projecting to the future, we considered areas close to the standards (e.g., within 10 percent). There is ample reason to believe that public welfare effects are occurring at levels below the standards (e.g., regional haze).

It is unclear if the commenters are referring to the economic benefits assessment in Chapter 9 or the air quality information in Chapter 2. Quantified and monetized benefits as reported in the RIA are not used to justify the proposed rule. However, the commenter's basic comment is flawed.

EPA conducts its PM benefits analyses to quantify, as completely as possible, estimated changes in public health outcomes projected to result in the future from the implementation of alternative strategies to reduce PM air pollution. These analyses are based on currently available scientific information, which continues to provide no evidence of a threshold below which it can be assumed with confidence that no health effects occur.

In implementing programs to attain the PM NAAQS, emission controls may lead to reductions in ambient $PM_{2.5}$ below the standard in some areas in order to reduce ambient levels sufficiently to attain the standard in other areas, with levels above the standard. An assessment of benefits associated with changes in $PM_{2.5}$ only above the standard would thus provide only a partial picture of the projected benefits of reductions in emissions of pollutants which form $PM_{2.5}$.

While estimated benefits associated with changes in $PM_{2.5}$ below the standard (i.e., approaching the lower end of the range of PM levels observed in the health studies) are more uncertain than those above the standard, they cannot be rejected as legitimate components of the benefits analysis, which is intended to provide a "best estimate" of the benefits of projected changes in $PM_{2.5}$, rather than a high- or low-end estimate.

In addition, given that the epidemiological literature has generally not produced risk estimates based on threshold models, there would be additional uncertainties associated with assuming thresholds (or any other non-linear concentration-response functions) for the purposes of benefits analysis. In fact, the EPA Science Advisory Board's Advisory Council for Clean Air Compliance, which provides advice and review of EPA's methods for assessing the benefits and costs of the Clean Air Act under Section 812 of the Act, has advised that there is currently no scientific basis for assuming any specific threshold for the PM-related health effects considered in typical benefits analyses (EPA-SAB-Council-ADV-99-012, 1999). Also, the National Research Council, in its own review of EPA's approach to benefits analyses, has agreed with this advice. This advice is supported by the recent literature on health effects of PM exposure (Daniels et al., 2000; Pope, 2000; Rossi et al., 1999; Schwartz, 2000) which generally finds no evidence of a non-linear concentration-response relationship and, in particular, no evidence of a distinct threshold for health effects. The most recent draft of the EPA Air Quality Criteria for Particulate Matter (U.S. EPA, 2002) reports only one study, analyzing data from Phoenix, AZ, that reported even limited evidence suggestive of a possible threshold for $PM_{2.5}$ (Smith et al., 2000).

Thus, it is appropriate and reasonable to include the estimated benefits associated with all reductions in $PM_{2.5}$, both above and below the standard, using non-threshold models, to provide a comprehensive picture of the estimated public health impacts associated with projected future controls on PM precursor emissions.

7.1.4 Assumptions in the Health Benefits Analysis

7.1.4.1 Assumptions Should be Revised

What Commenters Said:

API and Marathon commented that certain assumptions in the health benefits analysis should be revised. Based on the CASAC expert opinion against the use of existing diesel exhaust lung cancer epidemiological data in quantitative risk assessment, EPA should use the draft reference concentration (RfC) for non-cancer endpoints for any quantitative health benefit analysis.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 47
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 43-44

Our Response:

In generating health effects incidence estimates for PM, the Agency used effects estimates based on epidemiology studies examining exposure to PM as a generic mixture. We did not use epidemiological studies that examined exposure to diesel exhaust specifically due to concerns about the transferability of concentration-response functions from worker study populations to the general public. Regarding the potential use of RfCs for non-cancer endpoints, incidence estimation conducted as part of cost-benefit analysis typically requires effects estimates that relate exposure to specific health endpoints (or the probability thereof) so that incidence counts for specific health effects can be generated. Threshold values such as RfCs typically identify levels of concern and can not be directly translated into health effects incidence (i.e., cases). This limits their utility in supporting cost-benefit analysis.

7.1.4.2 Use of PM and Ozone Health Effects Data

What Commenters Said:

API and Marathon commented that PM and ozone health effects data should not be used for quantifying health benefits. The commenters believe that prospective case cohort studies should be used for determining PM health benefits, if PM is used.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 47
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 43-44

Our Response:

The epidemiological study used as the basis for one of the key health effects included in the benefits analysis (the Pope 2002 reanalysis of the ACS study data used to generate mortality estimates in adults) is a prospective cohort study.

7.1.4.3 Use of Diesel RfC as a PM Threshold

What Commenters Said:

API and Marathon commented that by EPA's own RfC definition, it is not appropriate to assume no threshold for the non-cancer cardiac and respiratory health effects used to calculate benefits for this proposed rule. They believe that we should use the current diesel exhaust RfC of 5 ug/m3 as the threshold for benefits calculations.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 48
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 43-44

Our Response:

The final EPA Diesel *Health Assessment Document* follows the CASAC recommendation not to use the existing diesel exhaust lung cancer epidemiological data to develop a cancer potency for quantitative estimates of the benefits of controlling diesel exhaust PM. However, CASAC also agreed that EPA could use these data to calculate a possible range of carcinogenic risk that could be associated with exposure to diesel PM. This risk range is from 10^{-3} to 10^{-5} but could be as low as zero. For non-cancer effects, the EPA Diesel *Health Assessment Document* states that the RfC for diesel PM of 5 ug/m^3 is based on four well-conducted rat inhalation studies showing adverse pulmonary effects. There is a much broader range of studies including numerous studies on humans such as epidemiology studies cited in the both the rulemaking and the EPA Air Quality Criteria Document for Particulate Matter showing adverse cardiac and respiratory health effects for ambient PM of which diesel PM is an important component. Due to the broader nature of these studies and the fact that the EPA NAAQS for PM is based on total PM mass rather than specific components of that mass, it is more appropriate to use that larger data base to calculate non-cancer benefits for diesel PM. Furthermore, it is not appropriate to use the diesel RfC based on only four rat studies examining pulmonary effects to make a conclusion on non-cancer benefits of controlling diesel PM at levels below 5 ug/m^3. In any case, significant PM benefit from this rulemaking comes from reducing NOx which reduces the secondary formation of nitrate. The diesel RfC, in any event, would not be applied to nitrate or sulfate.

In addition, for reasons mentioned earlier, typically, RfCs can not be used to support benefits estimates (see response to Question 1 above).

7.1.4.4 Estimates of Diesel PM Concentrations

What Commenters Said:

API and Marathon commented that EPA should acknowledge that current, worst-case estimates of diesel PM are well below EPA's proposed RfC for diesel exhaust, which is 5.0 ug/m3. Worst-case estimates by California EPA of annual average exposure concentrations to diesel PM from on-road and off-road diesel engines are 1.5, 1.3, and 1.2 ug/m3, for 1990, 2007, and 2020, respectively.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 48
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 44-45

Our Response:

PM resulting from diesel emissions are only one of many anthropogenic and natural sources of ambient $PM_{2.5}$. Consequently, in considering the potential for health impacts resulting from $PM_{2.5}$ exposure (in relation to health benchmarks such as RfCs which are based on thresholds), it is important to consider the total $PM_{2.5}$ concentration and not only the fraction resulting from a specific sources such as diesel emissions. However, in the context of benefits analysis where we use epidemiological-based effects estimates (i.e., linear and non-linear concentration-response functions) to translate changes in population-level exposure into reductions in health effects incidence, the important metric from an exposure standpoint is the delta or change in exposure and not the absolute levels of $PM_{2.5}$.

7.1.4.5 Epidemiological Analytical Software

What Commenters Said:

API and Marathon commented that, in light of recently discovered flaws in the analytical software used in many PM time series studies, calculations of benefits from health endpoints derived from time series studies should be removed from the RIA. These studies should not be used in the RIA until affected data are reanalyzed and peer reviewed to correct the Generalized Additive Models errors in default "convergence criteria" and the underestimation of standard errors, and until the co-pollutant effects on PM health effects are reanalyzed. Given these concerns, they believe that the majority of the alternative health benefit calculations should not be used since they are based on a broader number of time series studies than currently included in the base benefit calculations.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 48
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 44-45

Our Response:

The comment incorrectly identifies the use of default convergence criteria in the S-Plus statistical package's Generalized Additive Models (GAM) procedures as a "flaw." The use of default criteria is a decision made be the investigator, and more stringent criteria can be used without modifications to the base S-Plus statistical software.

Since the nonroad rule proposal, the Health Effects Institute has published its "Revised Analyses of Time-Series Studies of Air Pollution and Health." In it, the HEI special review committee presented the results of analyses of an HEI-funded study, the National Morbidity, Mortality, and Air Pollution Study (NMMAPS), as well as other non-HEI studies that employed the GAM procedure.

The reanalysis of the NMMAPS study found a decrease in the mean effect of PM-10 on mortality, from 0.41% per 10 ug/m3, to 0.27% per 10 ug/m3 when using GAM with more stringent convergence criteria, and 0.21% per 10 ug/m3 when using generalized linear models (GLM) using parametric approaches. In all models, the mean effect of PM-10 on mortality remained statistically significant. The decreases in the mean effect of PM-10 on hospitalizations due to cardiovascular diseases and chronic obstructive pulmonary disease were smaller, and a significant association continued to be present.

The HEI committee also reviewed 21 publications containing reanalyses of other time series studies using the default GAM convergence criteria. Overall, GAM approaches with more restrictive convergence criteria and GLM approaches using natural splines showed lower PM effect sizes, but overall, a PM effect was preserved in most studies. In most cases in which reduction did occur, the reduction was not substantial. Overall, the GAM issue has been largely resolved, and so this comment is no longer applicable.

7.2 Economic Impact Analysis

What We Proposed:

We prepared a draft Economic Impact Analysis (EIA) for this rule to estimate the economic impacts of the proposed control program on producers and consumers of nonroad engines, equipment, fuel, and related industries. An EIA is prepared to inform decision makers within the Agency about the potential economic consequences of a regulatory action. The analysis contains estimates of the social costs of a regulatory program and explores the distribution of these costs across stakeholders. These estimated social costs can then be compared with estimated social benefits. As defined in EPA's *Guidelines for Preparing Economic Analyses*, *social costs* are the value of the goods and services lost by society resulting from a) the use of resources to comply with and implement a regulation and b) reductions in output.[37] In this analysis, social costs are explored in two steps. In the first step, called the *market analysis*, we estimate how prices and quantities of goods directly and indirectly affected by the emission control program can be expected to change once the emission control program goes into effect. The estimated price and quantity changes for engines, equipment, fuel, and goods produced using these inputs are examined separately. In the second step, called the *economic welfare analysis*, we look at the total social costs associated with the program and their distribution across stakeholders. The analysis is based on compliance cost estimates and baseline market conditions for prices and quantities of engines, equipment, and fuel produced presented earlier in this section.

The Nonroad Diesel Economic Impact Model (NDEIM) uses a multi-market analysis framework that considers interactions between regulated markets and other markets to estimate how compliance costs can be expected to ripple through these markets. In the NDEIM, compliance costs are directly borne by engine manufacturers, equipment manufacturers, and petroleum refiners and fuel distributors. Depending on market characteristics, some or all of these compliance costs will be passed on through the supply chain in the form of higher input prices for the application markets (in this case, construction, agriculture, and manufacturing) which in turn affect prices and quantities of goods produced in those application markets. Producers in the application markets adjust their demand for diesel engines, equipment, and fuel in response to these input price changes and consumer demand for application market outputs. This information is passed back to the suppliers of diesel equipment, engines, and fuel in the form of purchasing decisions. The NDEIM explicitly models these interactions and estimates behavioral responses that lead to new equilibrium prices and output for all sectors and the resulting distribution of social costs across the modeled sectors.

The market impacts of this rule suggest that the overall economic impact on society is expected to

[37] *EPA Guidelines for Preparing Economic Analyses*, EPA 240-R-00-003, September 2000, p 113.

be small, on average. According to this analysis, price increases of goods and services produced using equipment and fuel affected by this rule (the application markets) are expected to average about 0.1 percent per year. Output decrease in the application markets are expected to average less than 0.02 percent for all years. The price increases for engines, equipment, and fuel are expected to be about 20 percent, 3 percent, and 7 percent, respectively (total impact averaged over the relevant years). The number of engines and equipment produced is expected to decrease by less than 250 units, and the amount of fuel produced annually is expected to decrease by less than 4 million gallons.

The welfare analysis predicts that consumers and producers in the application markets are expected to bear the burden of this proposed program. In 2013, the total social costs of the rule are expected to be about $1,510 million. About 83 percent of the total social costs is expected to be borne by producers and consumers in the application markets, indicating that the majority of the costs associated with the rule are expected to be passed on in the form of higher prices. When these estimated impacts are broken down, 58.5 percent are expected to be borne by consumers in the application markets and 41.5 percent are expected to be borne by producers in the application markets. Equipment manufacturers are expected to bear about 9.5 percent of the total social costs. These are primarily the costs associated with equipment redesign. Engine manufacturers are expected to bear about 2.8 percent; this is primarily the fixed costs for R&D. Nonroad fuel refiners are expected to bear about 0.5 percent of the total social costs. The remaining 4.2 percent is accounted for by locomotive and marine transportation services.

Total social costs continue to increase over time and are projected to be about $2,046 million by 2030 and $2,227 million in 2036 ($2002). The increase is due to the projected annual growth in the engine and equipment populations. Producers and consumers in the application markets are expected to bear an even larger portion of the costs, approximately 96 percent. This is consistent with economic theory, which states that, in the long run, all costs are passed on to the consumers of goods and services.

The present value of total social costs through 2030 is estimated to be about $27.2 billion ($2002). This present value is calculated using a social discount rate of 3 percent from 2004 through 2036. We also performed an analysis using an alternative 7 percent social discount rates. Using that discount rate, the present value of the social costs through 2036 is estimated to be $13.9 billion ($2002).

We received comments on our draft analysis from stakeholders representing agricultural interests, equipment rental and dealer interests, and equipment manufacturers. The commenters conveyed their concerns about our general analytic approach and some of the model assumptions. These comments, and our responses, are presented below.

7.2.1 EPA Failed to Perform an Adequate Analysis of Application Market End Users That Will Be Affected by the Rule

7.2.1.1 EPA Did Not Consider the Economic Impacts on End-users in the Agricultural Sector

What Commenters Said:

EPA received comments from twelve organizations representing farming and ranching interests (see list below). These commenters expressed concern that EPA did not consider "the economic impacts to those who will ultimately pay for compliance with the rule through higher fuel and equipment costs, namely end consumers, specifically farmers and ranchers." They note that while EPA states in the draft EIA that compliance costs "will be passed through to the application markets in the form of higher prices to the consumers of final construction, agricultural, and manufactured goods and services," EPA does not provide any analysis of what that will mean to those consumers. They note that EPA justifies its lack of analysis of the impacts on the application markets by assuming that "nonroad diesel equipment and fuel expenditures are a relatively small share of total production costs for the products and services that use this equipment and fuel as inputs." EPA further assumes that the consumers of the regulated products (e.g., farmers and ranchers) "will continue to purchase these products at these higher costs because there are no substitutes for nonroad diesel equipment and fuel."

These farming and ranching interests note that while some industries can absorb the higher costs for diesel engines, equipment and fuel associated with the rule, this is not the case for the agricultural sector. They note that "farmers and ranchers tend to be price takers that sell wholesale commodities." Because they do not set the prices for their output, "there is a limited ability to pass on increased regulatory burdens through to customers," and "even small increases in input costs translate into nonrecoverable lost profits for farmers and ranchers." Farmers have narrow profit margins, and "additional costs from increased regulatory burdens further erode their already shrinking profit margins."

These commenters also note that "the general assumption that diesel engine equipment and fuel account for a minute amount of total production costs for farm and ranch operators is questionable." For example, "the University of Nebraska Farm Management guides alone recognize more than 150 different machinery and equipment costs for Nebraska ag operations." Several commenters noted that the fuel requirements alone will have an economic impact in excess of a quarter of a billion dollars per year on the agricultural sector (7 cents a gallon cost increase, on 4 billion gallons of fuel consumed per year). This estimate does not include additional infrastructure or upgraded equipment/engine costs.

These commenters insist that EPA prepare a sector-by-sector analysis of the proposed rule's impact, specifically on farmers and ranchers. In addition, the USDA should be involved in this analysis because agricultural producers look to that agency "to perform economic analysis of regulations that affect their bottom lines and the prosperity of the national farm economy."

<u>Letters:</u>
American Farm Bureau, OAR-2003-0012-0608 p. 2-3
Idaho Wheat Commission, et. al., OAR-2003-0012-0645 p. 1
Illinois Farm Bureau, OAR-2003-0012-0673 p. 1-2
Kansas Farm Bureau, OAR-2003-0012-0825 p. 1-2
Michigan Farm Bureau, OAR-2003-0012-0625 p. 1-2
National Association of Wheat Growers, et. al., OAR-2003-0012-0752 p. 1
Nebraska Farm Bureau, OAR-2003-0012-0514 p. 1-2
Tennessee Farm Bureau, OAR-2003-0012-0629 p. 1-2

Our Response:

The EIA prepared for this rule was developed by EPA using widely accepted econometric practices, following the Agency procedures described in "Guidelines for Preparing Economic Analyses" (EPA 240-R-00-003, September 2000) and in "OAQPS Economic Analysis Resource Document" (April 1999). Copies of both of these documents are available in the docket for this rule. EPA develops the EIA for a particular control program as part of our regulatory development process. EPA is solely responsible for this rulemaking and we do not believe it is appropriate to delegate this work to other federal departments or agencies. It should be noted that other appropriate branches of the federal government are asked to review and comment on our analysis as part of the inter-agency review process.

As explained in Chapter 10 of the RIA prepared for this rule, the EIA looks at price and quantity impacts for engine, equipment, diesel fuel, and goods produced with these inputs (market analysis) and changes in producer and consumer surplus associated with those market effects (economic welfare analysis). The EIA considers 7 engine markets, 42 equipment markets, 8 fuel markets, 3 application markets, and 2 transportation service markets, for a total of 62 integrated product markets.

The application markets are the markets associated with the production and consumption of goods that use the affected diesel engines, equipment, and fuel. The producers in these markets include farmers, ranchers, construction firms, industrial firms, and mines; consumers include other companies and households. These three application markets – agriculture, construction, and manufacturing – were selected because they encompass the majority of the final products and services that incorporate diesel engines in their production processes and because they represent a manageable number of markets. As we indicated in the proposed (and also, the final) RIA, the analysis of the economic impacts for these three application markets focuses on impacts at the market level: average price and quantity change for output produced in each of the three markets (market analysis) and the average loss of consumer or producer surplus (economic welfare analysis). The EIA does not examine economic impacts on particular groups of application market suppliers (e.g., the profitability of farm production units or manufacturing or construction firms) or particular groups of consumers (e.g., households and companies that consume agricultural goods, buildings, or durable or consumer goods). In other words, while the EIA results indicate that the application markets are expected to bear most of the burden of the regulatory program and we apportion the decrease in application market surplus between application market producers and application market consumers, the EIA does not allow us to estimate how those social costs will be shared among specific application market producers and consumers (e.g., farmers and households). In some cases, application market producers may be able to pass most if not all of their increased costs to the ultimate consumers of their products; in other cases, they may be obliged to absorb a significant portion of these costs.

These commenters requested that instead of performing the EIA on at the application market level, EPA should perform a sector-by-sector analysis of application market consumers and producers because firms in different submarkets or firms of varying size may not be affected in the same way. These commenters did not provide any data to support their comments.

We do not believe a sector-by-sector analysis is called for in this case. This is because the standards in this emission control program are technical standards that apply to nonroad engines, equipment, and fuel regardless of how they are used. The structure of the control program does not in itself suggest that different sectors will be affected differently by the requirements. The standards will apply to all engines of a particular power category in the same way, and the impact on prices and quantities of engines in that power category are expected to be the same no matter how the engine is ultimately used. In addition, the NDEIM incorporates market-level behavioral parameters (supply and demand elasticity estimates) that were obtained from the literature or were estimated based on well-accepted econometric methods. Because these are market-level elasticities, they incorporate existing differences in reactions with the market. Therefore, differences among firms within a market are reflected in the average price and quantity changes for each application market and the average change in consumer and producer welfare. While there may be differences among the ability of particular firms or firms in a particular subsector to pass costs along to consumers of their goods, these differences are independent of this emission control program and are not expected to be affected by it.

It should also be remembered that diesel engines, equipment, and fuel affected by this control program represent only a small portion of the total production costs for each of the three application market sectors (the final users of the engines, equipment and fuel affected by this rule). Other more significant production costs include land, labor, other capital, raw materials, insurance, profits, etc. These other production costs are not affected by this emission control program. This is important because it means that this rule directly affects only a small part of total inputs for the relevant markets. Therefore, this rule is not expected to have a large adverse impact on output and prices of goods produced in the three application sectors.

Finally, the results of our EIA suggest that the overall burden on the application market is expected to be small: 0.1 percent increase in prices, on average, and 0.02 percent decrease in production, on average. See RIA Chapter 10 Appendix C. We believe that estimated economic impacts of this size do not warrant performing a sector-by-sector analysis to investigate whether some subsectors may be affected disproportionately. Nor does the statutory directive to consider costs in conjunction with engine standards, fuel standards, and lead time require any such analysis.

7.2.1.2 EPA Did Not Consider the Economic Impacts on End-users in the Equipment Distributor and Rental Sectors

What Commenters Said:

EPA received comments from three equipment dealer associations. These comments also raised the concern that "the agency appears to be skipping over the end users of nonroad equipment – those who would be forced to accept the costs of this rule." They note that the nonroad equipment market is narrow compared to the highway sector, and this rule "would add significant costs to the industry in terms of wholesale prices to dealers and retail prices to consumers." They said they are disappointed that EPA did not seek them out when developing the rule. The dealer associations also note that EPA did not consider the economic impact of increased oil change intervals on those who do oil changes.

American Rental Association noted that the equipment rental business is a competitive business, and that "cost increases are not fully transferred to the customer; the rental dealer will absorb some of these additional costs thereby affecting the economic performance of his business and the value of the rental proposition."

Letters:
American Rental Association, OAR-2003-0012-0612 p. 3
Far West Equipment Dealers Association, OAR-2003-0012-0679 p. 3
North American Equipment Dealers Association, OAR-2003-0012-0647 p. 3-4
Ohio-Michigan Equipment Dealers Association, OAR-2003-0012-0747 p. 3

Our Response:

We respond to the request for sector-by-sector analysis for application market subsectors with regard to equipment dealers and firms that do oil changes in the response to comment 7.2.1.1, above.

With regard to equipment rental companies, the commenters suggest that the behavioral characteristics of this market are sufficiently different from those for original equipment dealers (i.e., the market demand and supply elasticities are different than those for original equipment dealers) as to warrant separate analysis. These commenters do not provide supporting data. Our response to comment 7.2.1.1 with regard to requests for sector-by-sector analysis also applies here. In addition, even if the rental and original equipment dealer sectors were different, we do not believe this emission control program will change the currently existing dynamics of the equipment rental sector. In general, firms rent nonroad equipment for specific reasons, for example because they do not have a long-term need for the equipment or they would not use the equipment intensely enough to justify purchasing it. While it may be the case that individual rental firms may be able to pass along more or less of their increased costs to their customers, this is a function of the characteristics of individual firms. This rule is not expected to change that dynamic.

Finally, EPA held public hearings at three locations after publication of the proposed rule. In addition, there was an extensive comment period, of which these commenters availed themselves. It is our goal to take into account the concerns of all stakeholders.

7.2.1.3 EPA Did Not Include in its Analysis Potential Impacts on the Used Equipment Market

What Commenters Said:

Commenters representing agricultural interests noted that EPA did not include in its analysis potential impacts on the used equipment market. These commenters did not provide any details as to what those impacts would be.

<u>Letters:</u>
American Farm Bureau, OAR-2003-0012-0608 p. 3
Kansas Farm Bureau, OAR-2003-0012-0825 p. 2
Michigan Farm Bureau, OAR-2003-0012-0625 p. 3
Nebraska Farm Bureau, OAR-2003-0012-0514 p. 2
Tennessee Farm Bureau, OAR-2003-0012-0629 p. 3

Commenters representing equipment dealer interests also raised concerns about the impact of the rule on the used equipment market. Nonroad equipment often has a long useful life and equipment produced 30 years ago or more is a large share of the used equipment market. They note that dealers "have a tremendous financial stake in the used market and so do many end users" but "EPA is mostly silent on this issue." They note that the used equipment market "could possibly be on the verge of a huge upswing if this proposed regulation prices new engines and equipment out of the range of most customers."

The dealer associations raise three questions about the impact of the rule on the used equipment market:

(1) Will used equipment be able to continue running on the new ultra-low sulfur diesel fuel of only 15 ppm sulfur?
(2) Will EPA suggest a retrofitting requirement?
(3) Will this rule affect the sale of used equipment in general?

Letters:
Far West Equipment Dealers Association, OAR-2003-0012-0679 p. 3
North American Equipment Dealers Association, OAR-2003-0012-0647 p. 4
Ohio-Michigan Equipment Dealers Association, OAR-2003-0012-0747 p. 3

Our Response:

We respond to the request for sector-by-sector analysis (i.e., used equipment dealers) in the response to question 7.2.1.1, above.

To some extent, these comments reflect a misunderstanding about the scope of the new standards. It is expected that existing equipment will be able to continue running on the new ultra-low sulfur fuel (there is no technical reason that it cannot) and may even see a decrease in operating costs as a result (see discussion on operating costs in Chapter 6 of the RIA). This rule is also not expected to affect the sale of used equipment, since it has no direct effect on such equipment (there being no retrofit requirement in the rule). Also, since the rule is not expected to significantly increase the price of most types of new equipment (the average price increase across all equipment is expected to be about 2.9 percent in 2013 and 2.5 percent in 2020 and beyond), there is not expected to be a significant increase in demand for used equipment. See RIA Chapter 10 Appendix B.

It should be noted that even if the price increases for new equipment were large enough to drive consumers to purchase used instead of new equipment, the result would be a transfer from new equipment dealers to used equipment dealers and not an additional cost, and would be among end users in the same equipment market. As noted above, this model is not designed to assess the distribution of economic effects at the firm level of analysis.

7.2.2 EPA's Treatment of Fixed Costs in its Economic Impact Analysis Is Incorrect

What Commenters Said:

The New York Department of Environmental Conservation commented that EPA's "statements regarding Fixed Costs and Total Costs, and their impact on prices" are inaccurate and contrary to economic principles. This commenter notes that by not considering fixed costs in the economic analysis, EPA underestimates total costs, marginal costs, and prices. This is because the marginal cost curve is a derivative of the total cost curve, which includes fixed costs. While in the long run total costs are not determined by changes in fixed costs, initially total costs are determined by both fixed and variable costs. While EPA asserts that because "fixed costs are primarily R&D costs ... and firms in the affected industries currently allocate costs for these costs," R&D costs matter because they are compliance costs regardless of when they are incurred. The NY DEC recommends that EPA include R&D in the NDEIM. They expect that the result will be an increase in the average price of goods and services produced using engines affected by the rule.

Letters:
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 9

Our Response:

As this commenter notes, the EIA treats the fixed costs expected to be incurred by engine and equipment manufacturers differently in the market and social costs analyses. In the market analysis, estimated engine and equipment market impacts (changes in prices and quantities) are based solely on the expected increase in variable costs associated with the standards. Fixed costs are not included in the market analysis because in an analysis of competitive markets the industry supply curve is based on its marginal cost curve and fixed costs are not reflected in changes in the marginal cost curve. In addition, the fixed costs associated with the rule are primarily R&D costs for design and engineering changes. Firms in the affected industries currently allocate funds for R&D programs and this rule is not expected to lead firms to change their R&D budget decisions. Therefore, changes in fixed costs for engine and equipment redesign associated with this rule are not likely to affect the prices of engines or equipment. Fixed costs are included in the social cost analysis, however, as an additional cost to producers. This is appropriate because even though firms currently allocated funds to R&D those resources are intended for other purposes such as increasing engine power, ease of use, or comfort. These improvements will therefore be postponed for the length of the rule-related R&D program. This is a cost to society.

7.2.3 EPA's Assumption of Perfectly Competitive Markets Is Incorrect

What Commenters Said:

The Mercatus Center commented that EPA's NDEIM relies on the assumption of perfect competition. However, this description of the nonroad market does not hold. For example, in its Industry Characterization, EPA notes that Kubota has a 28.6 percent market share for the 25 to 75 horsepower category, and the percentage shares for the next eight largest firms decline rapidly. EPA also notes that nine firms have 88 percent of the market, and 19 firms share the remaining 12 percent for an average share of 0.63 percent each.

The Mercatus Center notes that the reality of this market structure has implications on the economic analysis. Specifically, EPA assumes that all firms can spread their costs out over a large number of engines, when it is clear that some cannot. The analysis also assumes that firms can spread their costs over all of their production, including engines offered on the global market, when in fact some small firms do not compete in the world market. EPA also assumes that small firms will have access to information so that the size of the firm does not affect information costs when in fact the costs of obtaining that information may be too high for small firms.

Letters:
Mercatus Center, OAR-2003-0012-0627, 0828 p. 43-45

Our Response:

Mercatus expresses concern that the number of firms that produce engines in the 25 to 75 horsepower range is relatively small, calling into question the assumption of perfect competition in the

NDEIM. While the commenter is correct in noting the limited number of firms in this subsector, we believe it is still appropriate to rely on the perfect competition assumption in this analysis.

It should be noted that the production numbers cited in the industry characterization are for U.S. production only. The actual total production of many of these companies can be significantly larger. For example, in the 25 to 75 hp category, many of the engine companies with small U.S. market share, such as Lombardini and Lister-Petter, sell engines in Europe, the Far East, and to other global markets. The U.S. share of their production is only one part of their total production.

Market concentration is measured in a variety of ways by the Department of Justice (DOJ) and Federal Trade Commission (FTC), including four-firm concentration ratios (CR4) and the Herfindahl-Hirschman Index (HHI). The CR4 is simply the combined market share of the four largest sellers in a given market, a very intuitive concentration measure. The HHI, which is currently used by the DOJ's Antitrust Division and the FTC, is constructed by summing up the squared market shares, in percentage terms, of all competitors in the market. According to these agencies' 1997 Horizontal Merger Guidelines, a market with an HHI under 1,000 is considered "unconcentrated," one with an HHI between 1,000 and 1,800 is "moderately concentrated," and one with a measure over 1,800 is "highly concentrated" (DOJ, 1997).

The merger guidelines assume that high concentration offers the potential for firms to influence prices through coordinated action on prices. Still it is possible for highly concentrated markets to behave competitively if firms are unwilling or unable to coordinate their actions or if potential entry can serve to limit price increases. For diesel engine markets, the following HHI values were calculated:

- Entire diesel engine market – all hp ranges 885 (unconcentrated)
- Small engines (1 to 70 hp) 1,202 (moderately concentrated)
- Medium engines (71 hp to 600 hp) 1,804 (highly concentrated)
- Large engines (over 600 hp) 3,662 (highly concentrated)

These data suggest that concentration in the small engine market is low enough that an assumption of competitive behavior is appropriate.

In the medium range, the high level of concentration is mitigated by substantial competition from foreign manufacturers, who would be unlikely to coordinate actions with U.S. firms and may have strong incentives to compete vigorously on price. The over 600 hp engine category would seem to be more problematic, with Caterpillar selling more than half of the large diesel engines used in U.S.-produced nonroad equipment. Here too, however, competition from overseas firms may serve to keep the market competitive.

The perfect competition assumption relies not only on the number of firms in a market but also on other market characteristics. For example, there are no indications of barriers to entry, the firms in these markets are not price setters, and there is no evidence of high levels of strategic behavior in the price and quantity decisions of the firms. In addition, the products produced within each market are somewhat homogeneous in that engines from one firm can be purchased instead of engines from another firm.

Finally, according to contestable market theory, oligopolies and even monopolies will behave very much like firms in a competitive market if it is possible to enter particular markets costlessly (i.e., there are no sunk costs associated with market entry or exit). With regard to the nonroad engine market, production capacity is not fully utilized. This means that manufacturers could potentially switch their product line to compete in another segment of the market without a significant investment. For all these reasons, the number of firms in a particular engine submarket does not prevent us from relying on the perfect competition assumption for that submarket. This is true of other engine and equipment subsectors as well. In addition, changing the assumption of perfect competition based on the limited evidence raised by the commenter would break with widely accepted economic practice for this type of analysis.[38]

The second part of these comments challenges EPA's assumption that firms will be able to spread compliance costs over a large number of engines. EPA is not aware of any small firms that sell engines or equipment in the United States but do not sell them in Europe or Japan. In addition, the program contains flexibility provisions for small manufacturers that are designed to address compliance difficulties they may have with respect to information and design costs. It should be noted that most if not all small firms that operate in the nonroad engine and equipment market provide products for niche markets. These firms should be able to pass on more of their costs than companies that provide products for more competitive markets. This suggests more of a benefit for manufacturers, with users bearing more of the costs of compliance.

7.2.4 EPA Did Not Include Substitution Effects in its Economic Analysis

What Commenters Said:

The Association of Equipment Manufacturers expressed concern that the increased cost of the rule "will serve to either delay the purchase of next generation nonroad equipment or lead operators to rebuild their older equipment." They also express concern that, for engines less than 19 kW (25 hp), there will be substitution to less expensive gasoline-powered equipment.

Ingersoll-Rand commented that "EPA presumes that customers will absorb the costs of new machines with new technologies." They note that their "customers, faced with a purchasing decision that involves significant expense and uncertain performance, may elect other alternatives such as pre-buying, delayed buying, rebuilding, extending the life of a current machine, or substituting with different equipment."

SBA Office of Advocacy noted that, during the Panel process conducted for this rule, small business equipment manufacturers expressed concern that the costs of the rule for engines below 75 hp "would increase the incremental cost of these smaller units to the point where customers would defer purchases of these units or purchase substitute products such as gasoline-powered equipment" and "to switch to other types of equipment or not purchase new equipment at all." They noted that EPA does not consider substitution effects, and note that "it is not likely that equipment purchasers would simply ignore the higher price and continue purchasing equipment at nearly the same rate they always have."

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[38]See, for example, *EPA Guidelines for Preparing Economic Analyses*, EPA 240-R-00-003, September 2000, p 126.

The New York State Department of Environmental Conservation raised a concern "that the proposed rule could potentially encourage equipment manufacturers to use smaller engine sizes that would not result in the desired decreases of emissions." They also note an additional concern "that the proposed regulations may drive manufacturers to switch to gasoline engines in pace of diesel engines," especially in low horsepower ranges.

The Mercatus Center commented that the assumption of no substitution is a "prime pillar" for supporting EPA's assumption of zero price elasticity. Yet, users can substitute by retaining their existing engines for a longer period of time through more intensive maintenance and repair. The result would be a decrease in engine sales. This is not considered in EPA's analysis.

The Tennessee Farm Bureau noted that EPA failed to consider the fact that farmers have become, and will continue to be, more energy efficient. New technologies and the mechanization of production have reduced the amount of equipment needed to produce a crop. In addition, this equipment accumulates less hours of running time because of increased horsepower ratings and no-till farming. This trend will continue.

Letters:
Association of Equipment Manufacturers, OAR-2003-0012-0669, 0670 p. 14
Ingersoll-Rand, OAR-2003-0012-0504 p. 9
U.S. Small Business Administration Office of Advocacy, OAR-2003-0012-0815 - 0818 p. 3
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 6
Tennessee Farm Bureau, OAR-2003-0012-0629 p. 1

Our Response:

The NDEIM does not explicitly model alternate production inputs that could serve as substitutes for new nonroad equipment or nonroad diesel fuel. In the model, market changes in the final demand for application goods and services directly correspond to changes in the demand for nonroad equipment and fuel (i.e., in normalized terms there is a one-to-one correspondence between the quantity of the final goods produced and the quantity of nonroad diesel equipment and fuel used as inputs to that production). We believe modeling the market in this manner is economically sound and reflects the general experience for the nonroad market.

Some commenters have suggested that substitution to alternate means of production other than new nonroad diesel equipment or nonroad diesel fuel is an economically rational possibility for these markets. The list of potential substitutes cited by these commenters include pre-buying, delayed buying, extending the life of a current machine, and substituting with different (e.g., gasoline-powered) equipment. For the reasons described below, we conclude that revising the NDEIM to include these effects would be inappropriate.

The term "pre-buying" refers to the possibility that the suppliers in the application market could choose to buy additional unneeded quantities of nonroad equipment prior to the beginning of the Tier 4 program and then use that equipment as an alternate means of production during the time period of the Tier 4 program, thus avoiding the higher cost for the Tier 4 equipment. Although such pre-buying may be economically rational in some very limited situations, its use as a substitute is severely limited. First, it should be clear that this form of pre-buying only applies to equipment and not to nonroad diesel fuel.

The high cost to storing any significant quantity of nonroad diesel fuel prior to Tier 4 makes such pre-buying unlikely. For nonroad equipment, the logic behind pre-buying is relatively straightforward and analogous to the average consumer deciding to buy a new car at the end of the model year in the anticipation that next year's model will be more expensive. The critical difference is that the nonroad equipment is bought early and then held idle until it is needed as an input to production. The economic viability of such strategic purchases are limited by the cost of idle capital and the cost for maintaining unused equipment. In simple terms, if one assumed that the value of capital tied up in an idle piece of equipment would have returned 7 percent in some other investment and the cost of equipment were to go up by 7 percent, it would be economically rational to pre-buy equipment up to one-year earlier than needed. If the equipment will not be needed as an input to production in the next year, it would be more rational to invest the money elsewhere and then purchase the equipment when it is actually needed. In real terms, the window for which pre-buying can be a rational choice is even more limited due to the cost of maintaining, storing and insuring equipment that is not being used. In practice then, such strategic purchases are limited to a time period of a few months around the start of a new regulation. The NDEIM is intended to model market reactions in the intermediate run time frame and thus models a period of time well beyond the scope of the short time period during which any potential pre-buy might be rational. We therefore have not tried to include pre-buying as a means of substitution in NDEIM.

"Delayed-buying" refers to the possibility that producers in the application market would defer purchasing new equipment initially but would eventually (after a delay period?) buy new equipment. The economic rationality of such a delay is not clear (i.e., commenters did not state what cheaper substitute might be used). However, since in the end it is assumed that the new more expensive equipment is purchased, such a substitution method would appear to be inappropriate for an economic model designed to model the intermediate run time frame.

In addition, there are many other factors besides a new regulatory program that may affect a consumer's decision to pre-buy or delay a purchase. Specifically, manufacturer short-term pricing promotions or marketing strategies such as rebates, dealer incentives, and advertising can change consumer behavior. These effects are not well captured in a general equilibrium model such as the one used in the NDEIM, the goal of which is to estimate the rule's impact on equilibrium prices and quantities. Distinguishing these effects would require the use of a sales function, which is beyond the scope of the NDEIM.

Extending the life of a current machine is suggested as another alternative to purchasing new equipment. We believe this would also be a short term phenomenon that is not relevant for the intermediate time frame of the NDEIM. Based on our meetings with equipment users and suppliers, we do not believe that extending the life of nonroad equipment will prove to be an economically rational substitute to the purchase of new equipment. Based on our understanding of the nonroad equipment market, we believe that most users of nonroad equipment already do this to the maximum extent possible. That is, we believe it is already economically rational to extend the life of nonroad equipment as long as possible. It is our understanding that new nonroad equipment is only bought when: 1) the existing equipment can no longer perform its function; or 2) when new demand for production requires additional means for production; or 3) when new equipment offers a cheaper means of production than existing equipment. The changes in equipment due to the Tier 4 program will not substantially change these three primary reasons for purchasing new equipment. Further, were we to discover that extending equipment life is economically rational (i.e., if it were cheaper to extend equipment life rather than to buy new equipment), this would lower the cost of nonroad equipment as an input to production and thus would reduce the economic impact of the Tier 4 program compared to our estimate. For all of the reasons stated here, we have decided not to attempt to model an extended equipment life in the NDEIM.

Finally, commenters suggested that equipment users may choose to substitute with different equipment or perhaps more generally different inputs to production. These could include the use of gasoline powered equipment, or the use of additional labor (i.e., the use of a laborer and shovel instead of a backhoe), or some other unknown substitute. We have specifically considered the possibility of substitution to gasoline technology. Gasoline engines are an alternative power source for equipment in the lowest power categories (i.e., below 75 horsepower). Above this size range there are very limited viable gasoline engine substitutes today, and we do not believe that such substitutes will arise in the future. We should also note that there are a number of benefits to diesel engines and some stakeholders have argued that there are no acceptable substitutes for diesel powered equipment.[39] The fuel economy advantage of diesel engines compared to gasoline engines dominates the overall operating costs for larger equipment and makes the application of large gasoline engines to large nonroad equipment economically infeasible.[40] For smaller nonroad equipment, where the fuel portion of operating costs are not as important, gasoline and diesel engines are both provided today. The dominant reasons for choosing diesel engines over the substantially cheaper gasoline engines include better performance from diesel engines, lower fuel consumption from diesel engines, and the ability to use diesel fuel. This latter reason is a significant advantage for two reasons: diesel fuel is safer to store and dispense due to its lower volatility and, hence, greater resistance to accidental ignition, and it is compatible with the fuel needed for larger equipment at the same worksite. Thus, the costs for addressing safety issues with gasoline fuel storage and the costs for storing two fuels onsite (gasoline for small engines and diesel for large) acts as a barrier to entry to the market for gasoline powered equipment. Where such a barrier doesn't exist, gasoline engines already enjoy a substantial economic advantage over diesel. In cases where the more expensive diesel powered equipment is currently used, an incremental increase in new equipment cost is unlikely to provide the necessary economic incentives for switching to gasoline based power systems. In short, we believe that users who can economically dispense gasoline fuel already choose the substantially cheaper gasoline technology, while diesel users are already choosing a more expensive technology due to reasons that will persist independent of today's rulemaking. The incremental equipment costs are not expected to be large enough to change these market characteristics. Therefore, we have not attempted to model the possibility of substitution to gasoline equipment in NDEIM.

7.2.5 EPA Failed to Account for the Price Sensitivity of Small Equipment Markets in its Economic Analysis

What Commenters Said:

Ingersoll-Rand commented that "EPA failed to account for the price sensitivity of these markets,

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[39] "To date, there is no substitute for diesel power." Associated General Contractors of America, OAR-2003-0012-0791.

[40] Preamble Table VI.C-1 documents the lifetime operating costs (for fuel and oil only) for a 500 hp bulldozer as $77,850. If simplistically, we assumed that a gasoline engine would have a 30 percent higher operating cost (in practice it would likely be higher), the extra operating cost for a gasoline engine would be in excess of $23,000 dwarfing any additional control cost from the Tier 4 program.

especially those associated with small engines." Ingersoll-Rand expects that "equipment using small engines will be severely impacted" because of the high compliance costs for those engines, which "could exceed the current cost of the engine." They provided an example of the price sensitivity of skid steer loaders. While the market has been relatively stable for 20 years, a price reduction of 5 to 7 percent in 1998 resulted in a 20 percent increase in sales. Consequently, they anticipate that their "customers will react unfavorably to cost increases from Tier 4, particularly when they will also encounter reduced durability, increased heat rejection, increased maintenance costs and lower fuel economy."

The Small Business Administration Office of Advocacy also commented on the price sensitivity of small equipment markets. They indicated they do not believe the expected engine price increases can be absorbed by the nonroad diesel equipment market and expressed concern that EPA did not consider substitution effects (switch to gasoline engines, cut back on diesel equipment by substituting labor, purchasing used equipment or extending the life of old equipment). This may be a particular concern for small equipment manufacturers, since the expected price increase for nonroad diesel engines in the 25 to 75 hp range is about 25 percent. They noted that "it is not likely that equipment purchasers would simply ignore the higher price and continue purchasing equipment at nearly the same rate they always have."

The Mercatus Center commented that EPA assumes that the demand price elasticity for nonroad diesel engines is not statistically different from zero, that it is totally inelastic. They note that real world examples of zero price elasticity are virtually nonexistent, even for cocaine or cigarettes. Mercatus stated that EPA provides no evidence that its estimated price elasticities are correct.

Letters:
Ingersoll-Rand, OAR-2003-0012-0504 p. 9
U.S. Small Business Administration Office of Advocacy, OAR-2003-0012-0815 - 0818 p. 5
Mercatus Center, OAR-2003-0012-0627, 0828 p. 46

Our Response:

With the exception of demand elasticities for the engine, equipment, and diesel fuel markets, the price demand and supply elasticities used in the NDEIM were obtained from peer-reviewed literature sources or were estimated using econometric methods. These econometric methods are well-documented and are consistent with generally accepted econometric practice.

The equipment and engine supply elasticities used in the NDEIM are elastic, meaning that quantities supplied are expected to be fairly sensitive to price changes. The supply elasticities for the fuel, transportation, and application markets are inelastic or unit elastic, meaning that the quantity supplied/demanded is expected to be fairly insensitive to price changes or will vary one-to-one with price changes. The demand elasticities for the application markets are also inelastic. This is consistent with the Hicks-Allen derived demand relationship, according to which a low cost-share in production combined with limited substitution yields inelastic demand.[41] As noted above, diesel engines, equipment, and fuel

[41] If the elasticity of demand for a final product is less than the elasticity of substitution between an input and other inputs to the final product, then the demand for the input is less elastic the smaller its cost share. Hicks, J.R., 1961. Marshall's Third Rule: A Further Comment. Oxford Economic Papers 13:262-65. See Note to the Docket from Jean Marie Revelt dated April 5, 2004 (Docket No. A-2001-28, Document No. IV-B-25).

represent only a small portion of the total production costs for each of the three application sectors. The limited ability to substitute for these inputs is discussed in the response to question 7.2.4, above.

Ingersoll-Rand's comments do not lead us to change our method of estimating the price sensitivity of these markets. The data provided by Ingersoll-Rand pertains to the experience of a price reduction for one type of equipment, Bobcat skid steer loaders. It is not surprising that the price decrease described led to an increase in sales for the company, given that the sales decrease was for Bobcat skid steer loaders only and did not apply to skid-steer loaders across the board. However, it is not possible to conclude anything about the general equipment elasticity for this market segment or the equipment market as a whole based on the experience of the result of market incentives for one company.[42]

The NDEIM is a market-level model that estimates the economic impacts of the rule on the engine, equipment, and application markets and the transportation service sector. It is not a firm-level analysis and therefore the equipment demand elasticity facing any particular manufacturer may be greater than the demand elasticity of the market as a whole. This difference can be important, particularly where the rule affects different firms' costs over different volumes of production. However, to the extent there are differential effects, EPA believes that the wide array of flexibilities provided in this rule are adequate to address any cost inequities that are likely to arise.

SBA Office of Advocacy's concerns about the price sensitivity of small equipment markets, and especially the impact of substitution, also do not lead us to change our methodology of estimating the price sensitivity of these markets. It should be noted that the expected price increase for engines should not be confused with the expected price increase for equipment. While the expected price increase for engines 26-50 hp and 51-75 hp is 22 percent and 21 percent, respectively, the expected price increase for equipment that use those engines is much smaller, ranging from 1.2 percent for industrial equipment 51-75 hp to 7.9 percent for gensets 51-75 hp. This range illustrates the relative value of the engine in total equipment input costs: the expected price increase is larger for gensets because the engine is a larger share of the total cost of equipment inputs. Equipment price increases of this nature are not expected to encourage equipment users to substitute labor for diesel equipment. See also our response to comments about substitution more generally in our answer to comment 7.2.4.

The inelastic values for the demand price elasticity questioned by Mercatus are an outcome of the NDEIM. Specifically, the demand elasticities for the engine, equipment, fuel, and transportation markets are internally derived as part of the process of running the model. This is an important feature of the NDEIM, which allows it to link the separate market components of the model and simulate how compliance costs can be expected to ripple through the affected economic sectors. For example, in the real world, the quantity of nonroad equipment units produced in a particular period depends on the price of engines (the engine market) and the demand for equipment (the application markets). Similarly, the number of engines produced depends on the demand for engines (the equipment market) which depends on the demand for equipment (the application markets). Changes in conditions in one of these markets will affect the others. By designing the model to derive the engine, equipment, transportation market, and

[42] The Nonroad Diesel Economic Impact Model described in Chapter 10 of the Regulatory Impact Analysis was prepared for EPA by RTI International. The contractor report containing the model equations and baseline data, is available in Docket A-2001-28, Document No. II-A-115. The contractor report containing modifications and enhancements to the model for the final rule is available in electronic docket OAR-2003-0012-1018.

fuel demand elasticities, the NDEIM simulates these connections between supply and demand among all the product markets and replicates the economic interactions between producers and consumers. The inelastic values for the demand elasticities for engines is a function of the inelastic demand for application market goods and the lack of substitution possibilities in addition to those that are already exercised today.

An underlying concern in the above comments is the extent to which the rule will affect the ability of small equipment manufacturers (i.e., small companies, not companies whose sales volumes are small) to compete with larger manufacturers. The nonroad equipment category includes a number of very large equipment manufacturers that control significant market share and have strong distribution channels that ensure their products are well positioned in the marketplace. Yet, as illustrated in our industry characterization, there are an even greater number of very small manufacturers that also produce nonroad equipment and that apparently are able to operate successfully in this market. In developing this rule, we have spoken with various equipment manufacturers to understand the nature of the nonroad equipment market and the conditions that allow such large and small manufacturers to coexist in a competitive marketplace. This information allows us to evaluate whether this rule may be expected to fundamentally change these market characteristics.

Generally, one would not expect that a small firm would be able to compete with a much larger equipment manufacturer in a high volume nonroad equipment market, such as the market for skid steer loaders. The larger manufacturer is expected to enjoy benefits due to reduced manufacturing costs from production efficiencies, reduced inputs from higher purchasing power from suppliers and reduced distribution costs from a broader product distribution network. Any design or production efficiencies that an innovative small manufacturer might create in order to compete would likely be quickly copied by its larger competitors and so would be unlikely to offset the advantages of the large manufacturer.

If it is assumed that nonroad equipment produced by the large and small manufacturers are of equal value to the customers in the market (they are homogeneous goods and are equally exchangeable, such as skid steer loaders), then we it can be assumed that these manufacturers must compete on price alone. Given the inherent cost advantages assumed to accrue to the larger manufacturer, it is difficult to imagine that a small manufacturer could succeed in such a market. Yet, there are a significant number of small nonroad equipment manufacturers. Consequently, the market must be more complicated than the simple competitive market described above.

Through our discussions with small equipment manufacturers, we learned that small equipment manufacturers do not typically compete directly with large equipment manufacturers. The nonroad equipment industry is characterized by innovative companies that identify new product needs not previously served or not served well by existing nonroad equipment. The companies develop new products to serve niche markets, sometimes even creating such markets. In fact, it is not uncommon for the brand name of the innovative products that create the markets to become synonymous with the products themselves. For example, many people today refer to all skid steer loaders as "bobcats" based on the brand name of the products that first created that market.

Other companies, including large equipment manufacturers, may enter the niche market if the volumes become sufficiently large (that is, the equipment application has broad applicability in the market). By that time, the innovator company will have grown with its market to become a much larger entity. This is what happened in the skid steer loader market.

For most small nonroad equipment segments, however, the markets are small enough that the relative cost of entry into the market will be a significant barrier to entry for larger companies. A large equipment manufacturer would have to weigh the low production volumes of the niche markets with the substantial design costs associated with entering such a market. The return that a large equipment manufacturer could hope to realize from entering such a market is likely to be so small as to make entry unappealing. In addition, the other advantages that a large equipment manufacturer may have, including a large distribution network and production efficiencies, are unlikely to offset these costs in a market where only a small number of units are sold a year. In niche markets, a very small equipment manufacturer with less bureaucracy and lower overhead may be in a better position to respond and innovate in a market, and may be more able to tailor each unit to meet the particular demands of each purchaser. This is certainly the case for rock crushing equipment for highway construction and is likely to be the case for other small nonroad equipment niche markets as well. We do not expect this rule to change the dynamics of these markets since the compliance costs are not high enough to offset the barriers to entry described above.

We do not know of any examples of equipment markets in which small nonroad equipment manufacturers compete directly with much larger companies offering homogeneous products.[43] Without a specific example to point to, we are left to speculate how such a situation could occur. One example may be the market for new home construction. In this market, large companies compete with much smaller high cost custom home builders. Both types of manufacturers provide the same basic output, homes. However, custom home builders exist and flourish even though their prices may be higher. This can occur because custom home manufacturers can compete by offering unique solutions custom tailored to the needs or desires of their end customers. Such market differentiation allows them to serve a much smaller, but potentially lucrative market. Similar mechanisms could exist for the nonroad equipment market as well in that a small manufacturer could provide a very specialized version of more generic equipment type (e.g., a forklift with spark arrestors for refinery applications) and could therefore differentiate itself enough from the main market to compete effectively. Again, we do not expect this rule to change this kind of product differentiation behavior to the extent it already exists.

In summary then, our observations in meeting with small equipment manufacturers and our own understanding of manufacturing processes lead us to conclude that in general small equipment manufacturers continue to thrive by identifying and serving narrow market niches. They do not directly compete with larger companies in these niche markets because of the relatively high cost of entry for large companies or because the economy of scale benefits to large companies do not apply in these markets.

We do not believe that the changes in due to the Tier 4 program will substantially impact the market characteristics described here. We are not projecting that nonroad equipment manufacturers will need to become significantly more sophisticated regarding emission control, we expect the engineering

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[43] We should note that we are aware of a number of medium to large nonroad equipment manufacturers that started as small companies and that now compete on a larger scale. Melrose, now part of Ingersoll Rand, created the first skid steer loaders marketed under the Bobcat name. Today, that market and the former Melrose company have grown significantly. A number of companies now serve the market including some of the largest manufacturers such as Caterpillar, John Deere, and Case New Holland. Similar small company market innovation and then growth into a much larger company can be found throughout the industry including, Vermeer, Charles Machine Works and even one of the best known names, Caterpillar.

sophistication will continue to reside with their engine supplier as it does today. We do recognize that the cost to redesign and develop a new equipment model can be expensive and that these expenses can be burdensome for a small volume manufacturer. We have addressed this specific issue through our TPEM program which provides up to seven years for small volume equipment manufacturers to continue to use existing engine models. Even given the relatively narrow market segments served by these companies, it is likely that they would have to redesign within the seven year period for reasons other than to accommodate new Tier 4 complaint engines (i.e., they will have to redesign product to remain competitive in the market). Thus the TPEM program will allow small manufacturers to align their redesign to accommodate new emission standards and their redesign to offer new features or functions into a single redesign event rather than two separate redesigns. This should substantially reduce the cost and burden for these small volume equipment manufacturers. See Chapter 6 of the Final RIA, Section 6.3.3, for additional discussion.

Finally, the above discussion does not affect our assumption of perfect competition with regard to the economic impact analysis (EIA) performed for that rule. Niche products are only a small share of the total nonroad equipment market. Because most nonroad equipment is produced and sold in competitive markets or in markets that behave like competitive markets, and because our EIA is a market-level analysis, it is appropriate to perform our economic impact analysis based on perfectly competitive markets.

7.2.6 Commenter Supports the Conclusions of EPA's Draft Economic Impact Analysis

What Commenters Said:

Breakthrough Technologies Institute commented that the small predicted increase in nonroad equipment (1 or 2 percent) will have a minimal impact on the demand for this equipment since the cost of compliance is relatively small compared to the overall cost of construction. This commenter also noted that the predicted increase in fuel costs (5 to 9 cents) is minimal and comparable to fluctuations that can occur on a weekly basis. In addition, EPA's cost numbers are typically overestimated and do not generally account for technological innovation.

<u>Letters:</u>
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665
Los Angeles Public Hearing
A-2001-28, IV-D-07 [BTI p. 160]
Chicago Public Hearing
A-2001-28, IV-D-06 [BTI p. 267]

Our Response:

We appreciate the commenter's support for our methodology and results.

7.2.7 Commenter Does Not Support the Conclusions of EPA's Draft Economic Impact Analysis

The Mercatus Center noted that EPA estimates the rule will result in an average engine price increase of about $1,000 and that engine sales are expected to fall by only 69 units. This is because EPA assumes that firms will be able to pass on virtually all compliance costs to end consumers, with the result that engine and equipment manufacturers will be virtually unaffected by the rule. Even if it were true that consumers would end up bearing the entire burden of the rule, there will still be economic costs since these consumers would have less disposable income to spend on other goods and services. While these effects are spread among so many firms and be indistinguishable from "noise," they are still economic impacts that are not considered in the analysis.

Mercatus also notes that EPA's analysis estimates a 23 percent increase in new engine prices, which is dependent on EPA's cost estimates. However, a relatively small firm could not survive if prices increase by only the average cost increase. The result would be a restructuring of the market as a whole.

Finally, Mercatus notes that the result of the analysis is that compliance cost exceed total social costs by a small amount. This result is unlikely because there are indirect market adjustments that "*add* social costs that equal or *exceed* the direct compliance costs associated with environmental regulations" (emphasis in original). EPA's finding that social costs are less than compliance costs implies that there are indirect effects of the rule that offset the costs of the rule. The commenter believes that this is unlikely.

Letters:
Mercatus Center, OAR-2003-0012-0627, 0828 p. 39-47

Our Response:

The Nonroad Diesel Economic Impact Model (NDEIM) uses a multi-market partial equilibrium approach to track changes in price and quantity for the modeled product markets. As explained in the *EPA Guidelines for Preparing Economic Analyses*, 'partial' equilibrium refers to the fact that the supply and demand functions are modeled for just one or a few isolated markets and that conditions in other markets are assumed either to be unaffected by a policy or unimportant for social cost estimation. Multi-market models go beyond partial equilibrium analysis by extending the inquiry to more than just a single market. Multi-market analysis attempts to capture at least some of the interactions between markets. In this model, the burden to consumers of all goods that use affected engines, equipment, and diesel fuel is modeled at the application market level and is grouped into three categories: agriculture, manufacturing, and construction. The loss of producer and consumer welfare at the application market level was estimated as part of the EIA, and is expected to be about $1,497 million in 2013 ($620.9 million loss of producer surplus and $875.7 million loss of consumer surplus). Thus, these economic impacts are considered in the analysis.

The NDEIM looks at market-level impacts and not at distributive impacts among firms in a particular sector or subsector. While it may be the case that, for a particular small firm, the average price increase may not cover the firm's increase in costs, it is also the case that the rule provides compliance flexibility provisions for small firms that will allow it to spread its costs out over more years and consequently more units. In general, the flexibility provisions were designed to minimize or even eliminate the adverse effects of the compliance costs on small businesses.

Finally, the results of the NDEIM suggest that total engineering costs exceed compliance costs by a small amount. This is due primarily to the fact that the estimated output quantities for diesel engines, equipment, and fuel are not identical to those estimated in the engineering cost analysis. The difference is due to the different methodologies used to estimate these costs. As noted above, social costs are the value of goods and services lost by society resulting from a) the use of resources to comply with and implement a regulation (i.e., compliance costs) and b) reductions in output. Thus, the social cost analysis considers both price and output (quantity) effects associated with consumer and producer reaction to increased prices associated with the regulatory compliance costs. The engineering cost analysis, on the other hand, is based on applying additional technology to comply with the new regulations. The engine population in the engineering cost analysis does not adjust to reflect consumer and producer reactions to the compliance costs. Consequently, the estimated output quantities from the cost analysis are slightly larger than the estimated output quantities from the social cost analysis.

8. ALTERNATIVE PROGRAM OPTIONS

What We Proposed:

For our Notice of Proposed Rulemaking (NPRM), we investigated a number of alternative program options involving variations in both the fuel and engine programs. The alternatives we considered can be categorized according to the structure of their fuel requirements: whether the 15 ppm fuel sulfur limit is reached in two steps, like the program we are finalizing today, or in one step. This section is therefore organized broadly into comments related to the one-step fuels program and comments related to the two-step fuels program. Section VII of the preamble provides a more detailed discussion of the alternatives.

8.1 One-Step Alternatives

One-step alternatives were those in which the 15 ppm fuel sulfur standard is applied in a single step. We evaluated three one-step alternatives. Option 1 represented an engine program that was similar to that in our proposed program, the primary difference being the generally earlier phase-in dates for the PM standards. We considered the Option 1 engine program as being the most stringent one-step program that could be evaluated as even potentially feasible considering cost, lead-time, and other factors. Option 1 also included a June 2008 start date for the 15 ppm sulfur standard applicable to nonroad diesel fuel and the 500 ppm sulfur standard applicable to locomotive and marine fuel. We also considered two other one-step alternatives which differed from Option 1. Option 1b differed from Option 1 regarding the timing of the fuel standards, while Option 1a differed from Option 1 in terms of the engine standards. Options 1a and 1b also differed from Option 1 by extending the 15 ppm fuel sulfur limit to locomotive and marine diesel fuel. Comments on sulfur standards applicable to locomotive and marine fuel are addressed in Section 8.3 below.

Since support or opposition concerning a one-step approach is closely tied to opposition or support concerning our proposed two-step program, some comments on this subject are presented in Section 4.3 in the context of discussion about our proposed program. Therefore, the reader is referred to Section 4.3 for further discussion of these issues.

8.1.1 Supports One-Step Approach

8.1.1.1 Approach Will Achieve Lower Sulfur Levels Earlier

What Commenters Said:

Several commenters believe that the one-step approach is favorable because it will achieve lower sulfur levels earlier that the two-step approach. These commenters believe that the two-step approach unnecessarily delays the availability of ultra low sulfur diesel fuel for new engines and retrofits of existing engines and offers a level of flexibility for refiners that may not be necessary. They further stated that the 15 ppm sulfur cap should be implemented in one step by 2008, or as soon as possible. The Pennsylvania Department of Environmental Protection noted that new refining technology and processes are being developed that will reduce the cost and complexity of reducing sulfur levels in diesel fuel and that under no circumstances should the 15 ppm standard be implemented any later than 2010.

The Alliance also commented that we should implement a one-step approach in 2008 since it is within the Tier 2 timeframe and can help highway ultra-low sulfur diesel supplies during the critical introduction period for Tier 2 vehicles and ease distribution of both fuel segments. They also noted that significant quantities of ultra low sulfur diesel are expected as early as 2004 for the highway market with no decrease in volume. The Alliance does not believe that refiners need six years lead-time to convert the majority of the distillate pool to 15 ppm, especially given the flexibility and incentives that will be provided.

Some commenters noted that, while they strongly prefer a one-step approach, they would consider a two-step approach under certain conditions (i.e. provided that the proposed schedule is maintained and/or the baseline approach to implementing the sulfur phase-in is taken). NY DEC noted that if the two-step approach is taken, the proposed implementation timeline should not be delayed. (See additional discussion under Issues 4.2 and 4.2.1).

We also received comments stating that the one-step approach would help states achieve compliance with the NAAQS. Further, SCAQMD recommended that EPA phase-in the 15 ppm sulfur standard earlier, to be consistent with the South Coast Air Quality Management District Rule 431.2. The City of Houston also noted that given the fact that they are already able to procure ultra-low sulfur fuel, it is disappointing that EPA proposes to implement the fuel sulfur standard in two phases, both of which come too late to help with their 2007 attainment of the 1-hour ozone standard or the continue attainment of the PM standard.

The Texas Commission on Environmental Quality (TX CEQ) recommends that the 15 ppm standard be implemented in one step by 2006 since: 1) several areas in Texas will be facing a 2010 or 2013 attainment date under the proposed 8-hour implementation rule, 2) national availability of this fuel by 2006 would eliminate the need for additional enforcement of nonroad diesel in Texas and California, and 3) a one-step approach would help maintain the integrity of highway diesel. They believe that we should expedite implementation so that all 8-hour ozone nonattainment areas can fully benefit from the reductions.

<u>Letters:</u>
Alliance of Automobile Manufacturers, OAR-2003-0012-0792 p. 2
City of Houston - Office of the Mayor, OAR-2003-0012-0630 p. 2-3
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 22-23
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 2
Pennsylvania Department of Environmental Protection, OAR-2003-0012-0699 p. 3
Regional Air Pollution Control Agency, OAR-2003-0012-0683 p. 2
South Coast Air Quality Management District, OAR-2003-0012-0623 p. 3, 6
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 9-10
Texas Commission on Environmental Quality, OAR-2003-0012-0716, 0717 p. 1
Union of Concerned Scientists, OAR-2003-0012-0830 p. 2-4
Wisconsin Department of Natural Resources, OAR-2003-0012-0702, 0703 p. 3
U.S. Public Interest Research Group, OAR-2003-0012-0780 p. 2
New York Public Hearing
A-2001-28, IV-D-05 [ED p. 151; NRDC p. 35; OTC p. 211; STAPPA/ALAPCO

p. 46; U.S. PIRG p. 189]
Los Angeles Public Hearing
A-2001-28, IV-D-07 [ALA p. 111, ALA-CA p. 174, ALA-LA p. 220; CCA p. 143; ED p. 93; SCAQMD p. 117; STAPPA/ALAPCO p. 28; U.S. PIRG p. 179]
Chicago Public Hearing
A-2001-28, IV-D-06 [ALA-Chicago p. 284; CAT p. 157; STAPPA/ALAPCO p. 38]

Our Response:

Factoring in lead-time and stability factors associated with both the fuel standards and engine standards, we believe that the 2-step program provides the greatest emission reductions achievable as early as possible.

There would be earlier NOx emission reductions with the one-step approach due to earlier introduction of aftertreatment technology enabled by the 15 ppm sulfur diesel fuel. However, the two-step approach provides earlier PM and SO2 emission benefits due to the earlier adoption of the 500 ppm sulfur standard, and a 1-step approach in 2008 or earlier could jeopardize the successful implementation of the highway diesel rule. Moreover, the costs for achieving the second step (15 ppm) of the two step approach are likely to be lower than under the one step approach. This is because advanced desulfurization technologies are much more likely to be used in 2010 after additional testing and demonstration, while they may hardly be considered at all if they would have to be installed for 2008. This cost discrepancy is expected to persist since it is associated with the investment of significant capital which cannot be modified or replaced without significant additional expense. Additionally, under the two step program, refiners will be able to use their experience in complying with 15 ppm highway diesel fuel sulfur standard to better design their nonroad hydrotreaters needed for 2010.

8.1.1.2 One-Step vs. Phase-In

What Commenters Said:

Some commenters believe that a one-step approach will be easier to implement than phase-in options. They are concerned that maintaining diesel fuel with different sulfur levels will increase the risk of cross-contamination, and believe that we should protect the gains made in the highway rule by holding all diesel fuels to 15 ppm starting in 2007. These commenters believe that a one-step approach will reduce the risk of cross-contamination and that the surest method for protecting emission controls from sulfur contamination is to hold all diesel fuels, including highway, nonroad, locomotive, marine and heating oil, to a 15 ppm standard as soon as possible. (See related discussion under Issue 4.2).

In addition, Sunoco noted that in many cases, the planning, engineering and permitting timeframes may be so long that companies will need to begin detailed analysis and design for the 2010 deadline even before 2007 capital projects are completed. They believe that areas with an already complex product slate will experience even greater risk of contamination and supply disruptions. Sunoco did not provide any additional information on a recommended implementation date.

Lastly, ARA believes that we should implement a one-step reduction in sulfur to 15 ppm for all diesel fuel prior to the introduction of sulfur sensitive controls on nonroad equipment since the presence of higher sulfur diesel in the market will create a significant risk to rental business equipment owners.

Letters:
American Rental Association, OAR-2003-0012-0612 p. 5
City of Houston - Office of the Mayor, OAR-2003-0012-0630 p. 3
Sunoco, OAR-2003-0012-0509 p. 1
Union of Concerned Scientists, OAR-2003-0012-0830 p. 3
Los Angeles Public Hearing, A-2001-28, IV-D-07 [CAT p. 184; UCS p. 69]

Our Response:

Both misfueling and cross-contamination are, we believe, an insignificant concern given the provisions of the FRM. We have designed the program to limit the number of grades of distillate in 2007 to the same three that resulted from the highway rule: 15 ppm, 500 ppm, and uncontrolled high sulfur. This approach minimizes complexity and reduces the chances for contamination. By requiring LM fuel produced by a refinery or imported to meet a sulfur standard of 15 ppm in 2012, we are also reducing the number of fuel grades that the distribution system must support compared to our proposal in which LM fuel would remain at 500 ppm indefinitely. We do not have authority to control heating oil, and thus cannot eliminate all sources of potential sulfur contamination. We have also built flexibility into the program to efficiently deal with contamination when it does occur. Today's rule also provides that 500 ppm diesel fuel produced due to interface mixing or transmix processing can continue to be used in nonroad equipment until 2014, and in locomotive and marine engines indefinitely, or in heating oil. This generation of 500 ppm diesel fuel will generally occur at the terminal level of the distribution system. See also our response to Issue 8.1.1.1.

Misfueling is principally a concern with 2011 and later model year equipment. As a result, whether our fuels program was implemented in one step or two steps, by the time the equipment is in the market, 15 ppm fuel will be required. We are confident that misfueling in 2011 and later will not be a significant issue, since the vast majority of distillate fuel available nationwide will be 15 ppm, and when 500 ppm fuel is available, it must be carefully segregated and labeled to avoid confusion. Furthermore, price differentials should be small enough to limit any incentive for intentional misfueling. See also our response to Issue 4.3.2.

8.1.2 Opposes One-Step Approach

What Commenters Said:

NPRA believes that a one-step alternative would complicate the process of ultimately achieving an ultra-low sulfur diesel standard. They commented that imposing a one-step 15 ppm ultra low sulfur diesel limitation on the heels of the compliance deadline for the highway program would interfere with three primary objectives of the program: 1) maintaining the benefits and program integrity of the highway diesel fuel program, 2) achieving the greatest reduction in sulfate PM and SO_2 emissions from NRLM diesel engines as early as practicable, and 3) preserving the volume of the total diesel fuel pool. Further, NPRA stated that a one-step alternative would not allow for the fungible shipment of highway and NRLM diesel fuel meeting the identical 500 ppm standard after it leaves the refinery. (See additional discussion under Issue 4.2).

Letters:
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 3-4

Our Response:

As discussed in our response to Issue 8.1.1.1, we are also concerned that a one-step program could interfere with implementing the highway diesel program. We further recognize that PM and SO2 benefits can be achieved earlier with the final two-step approach compared to a one-step approach. While we are not convinced that there would be a supply shortage under a one-step program, we believe that directionally the 2-step program does help reduce any remaining concerns. While we acknowledge that the design of the final two-step program provides greater opportunity for the continued fungible distribution of 500 ppm highway fuel during the Temporary Compliance Option, a benefit to refiners that would not be available under a one-step approach. While we are not relying on this as a basis for adopting the two-step approach, we recognize it as a consequence.

8.2 Other Two-Step Alternatives

Two-step alternatives were those in which the nonroad diesel fuel sulfur standard was set first at 500 ppm and then was reduced to 15 ppm. The two-step alternatives varied from the proposed program in terms of both the timing and levels of the engine standards and the timing of the fuel standards. Option 2a was the same as the proposed program except the 500 ppm fuel standard was introduced a year earlier, in 2006. Option 2b was the same as the proposed program except the 15 ppm fuel standard was introduced a year earlier (in 2009) and the trap-based PM standards began earlier for all engines. Option 2c was the same as the proposed program except the 15 ppm fuel standard was introduced a year earlier in 2009 and the trap-based PM standards began earlier for engines 175-750 hp. Option 2d was the same as the proposed program except the NOx standard was reduced to 0.30 g/bhp-hr for engines 25-75 hp, and this standard was phased in. Finally, Option 2e was the same as the proposed program except there were no new Tier 4 NOx limits.

Option 3 was identical to the proposed program, except that it would have exempted mining equipment over 750 hp from the Tier 4 standards. Option 4 included applying the 15 ppm sulfur limit to both locomotive and marine diesel fuel in addition to nonroad fuel. Comments on the 15ppm sulfur standard for fuel used in locomotives and marine fuel are addressed in Section 8.3 below rather than in this section.

Options 5a and 5b were identical to the proposed program except with respect to standards for engines less than 75 hp. Option 5a was identical to the proposed program except that no new program requirements would be set in Tier 4 for engines under 75 hp. Instead, Tier 2 standards and testing requirements for engines under 50 hp, and Tier 3 standards and testing requirements for 50-75 hp engines, would continue. The Option 5b program was identical to the proposed program except that for engines under 75 hp only the 2008 engine standards would be set, i.e. there would be no additional PM filter-based standard in 2013 for 25-75 hp engines, and no additional NOx+NMHC standard in 2013 for 25-50 hp engines.

Apart from comments on a 15 ppm sulfur standard for locomotive and marine diesel fuel (see Section 8.3 below), the various alternative two-step programs presented in our proposal were not a focus of the comments received. Many stakeholders provided comments on the one-step versus the two-step fuel program, and these are discussed in Section 4.3 in the context of support or opposition concerning our proposed two-step fuel program, or in Section 8.1 in the context of opposition or support concerning the alternative one-step fuel program. The few comments related to two-step alternatives to our proposed program are presented below. Our proposal provided a discussion for why we were not proposing a program incorporating the various elements exhibited by Options 2a through 5b. With the exception of Option 4 (15 ppm locomotive and marine fuel, discussed in Section 8.3 below), we have concluded that these Options should not be finalized, as described in the preamble.

8.2.1 Option 2b

What Commenters Said:

The Clean Air Task Force (CATF) urged EPA to adopt Option 2b. EPA's proposal not to advance the Tier 4 PM compliance dates by a year as set out in Option 2b appears to be primarily based on EPA's concern that the PM standards would be decoupled from the NOx standards, resulting in a large increase in engineering workload for engine and equipment manufacturers. We offer several responses to EPA's concern. First, these additional engineering costs have been included in EPA's incremental cost analysis of Option 2b, and as mentioned above, those costs are far outweighed by the incremental monetized benefits—by a factor of over *13*. Second, we believe that it will be feasible to pull-ahead the Tier 4 NOx standards by a year as well, so that they will coincide with the Tier 4 PM standards. The key issue for NOx control is the development of NOx adsorbers for highway engines by 2007. There is nothing fundamentally different or unique about applying NOx adsorber technology to nonroad engines thereafter. Therefore, CATF urged EPA to advance the Tier 4 NOx standards by beginning the 50% phase-in a year earlier than set forth in the Nonroad Proposal and requiring 100% compliance by the end of 2012.

Letters:
Clean Air Task Force, et. al., OAR-2003-0012-0508 p. 13

Our Response:

This comment is closely related to comments we received on the timeline for program implementation. Our response to all these comments can be found at Issue 3.1.1.4. In addition, we continue to believe that moving the start date of the 15 ppm nonroad standard forward by one year, a prerequisite for advancing the start date of trap-based PM standards, is not appropriate. For instance, moving up the 15 ppm standard for nonroad diesel fuel by one year would make the nonroad diesel fuel sulfur program more stringent than the highway diesel fuel sulfur program, which does not require 100% of highway diesel fuel to meet a 15 ppm cap until June 1, 2010. Some of the synergies obtained by the proposed program would also be lost. Also, the three year interval between the 500 ppm and 15 ppm caps for NR diesel fuel is roughly equal to the life of a desulfurization catalyst. Thus, many refiners would be bringing their 500 ppm desulfurization unit down for catalyst replacement right about the time that the additional equipment needed to meet the 15 ppm cap would need to be tied in. Implementing the 15 ppm cap one year earlier would require refiners to either replace their existing catalyst earlier than necessary or bring the unit down the next year again for another catalyst replacement. Comments we received on our proposal have not changed our views on this issue, and thus we are not finalizing Option 2b.

8.2.2 Option 3

What Commenters Said:

The Roundtable supports Option 3, based on the unique and customized nature of mining equipment engines. The Roundtable also requests that EPA provide a specific cost-benefit analysis of the continued exemption for this sector.

Letters:
Western Business Roundtable, OAR-2003-0012-0636 p. 4

Our Response:

We do not agree with the commenter's suggestion not to apply Tier 4 standards to above-ground mining equipment (i.e. option 3). We explained at length at proposal why this option was unwarranted at section 12.6.2.2.7 of the Draft RIA, and briefly summarize that response here. Mining engines have already been held to be properly subject to regulation under section 213, Engine Manufacturers Ass'n v. EPA, 88 F. 3d 1075, 1098 (D.C. Cir. 1996), and we are finding in this rule that further reduction in PM and NOx emission from these engines is technically feasible at reasonable cost. These engines emit very high volumes of PM and NOx, notwithstanding that they are sold in relatively small numbers. We have taken into account these engines' long design cycle and low annual sales volume in the long lead time provided in the rule, which includes the ABT and equipment manufacturer flexibility programs.

We note further, however, that we have made certain changes in the proposed standards for these engines. While retaining aftertreatment-based standards for PM for all greater than 750 hp engines, we are increasing the level of those standards based on technical concerns. We also are deferring a decision on whether to adopt an aftertreatment-based standard for NOx from greater than 750 hp engines in mobile machines, which would include aboveground mining equipment.

8.2.3 Options 5a and 5b

What Commenters Said:

The SBA Office of Advocacy urges the EPA to adopt either Option 5a or 5b in order to minimize burdens on small entities pursuant to the RFA and the President's Executive Order 13272. SBA Office of Advocacy believes that a large number of small manufacturers of equipment will be negatively affected by aftertreatment requirements for engines below 75 horsepower. Also, SBA Office of Advocacy noted that EPA is within its statutory discretion in reducing emissions for engines above 75 horsepower alone. SBA Office of Advocacy believes that the information developed during the exhaustive SBAR Panel process supports the adoption of the least burdensome alternatives, Options 5a or 5b. SBA Office of Advocacy noted that these alternatives resulting from the SBAR Panel process described above would achieve essentially the same emissions reductions as EPA's proposed regulatory approach while imposing significantly less regulatory burden upon small entity equipment manufacturers. SBA Office of Advocacy recommended that EPA adopt Option 5a or 5b because: (1) the incremental benefits of requiring aftertreatment for smaller engines do not justify the large differences in cost, (2) EPA has not demonstrated the technical feasibility of aftertreatment technology for nonroad diesel engines below 75 hp, and (3) small entities will bear an unfair and disproportionate share of the economic costs associated with this rule.

Letters:
U.S. Small Business Administration Office of Advocacy, OAR-2003-0012-0815--0818, p. 10

Our Response:

See our response to Issue 3.1.4.3 for a detailed response to this comment. As discussed in our responses to Issue 3.1.4.2 and 3.5.3, we continue to believe that aftertreatment-based PM standards are feasible for these engines with the lead time provided. As set out in detail in RIA 4.1.4.3.2.1, there is no technical reason that the standards cannot be achieved. The ability of a PM filter to trap and eliminate nearly all of the soot PM in the exhaust is well established and is not a function of engine power. Due to their typically lower fuel efficiency, some smaller engines do have a somewhat higher production rate of sulfate PM, which is not well controlled by a PM filter. However, this is addressed through the virtual elimination of sulfur in diesel fuel and, for the small residual amounts of sulfur left in the fuel, through our setting a higher Tier 4 PM standard level for under 75 hp engines compared to larger engines. We also explain in detail in the RIA how we expect these engines' exhaust temperature profile can be adapted to ensure regeneration of PM filters used by these engines, and our cost estimates include the cost of active regeneration systems for these engines to accomplish this. We also show that there are no significant issues regarding feasibility of equipment design or of safety for these engines. For additional responses to comments on technological feasibility, see Issues 3.1.4.2 and 3.5.3. EPA already responded to the commenter's assertions that additional PM standards for 0-75 hp engines are not warranted for reasons of cost or cost effectiveness at sections 12.5.7, 12.5.8, 12.6.2.2.9, and 12.6.2.2.10 of chapter 12 of the draft RIA. The commenter chose not to address that response in its public comment.

8.3 15 ppm Standard for Locomotive and Marine Diesel Fuel

In the NPRM, we requested comment on extending the 15 ppm cap to locomotive and marine diesel fuel beginning in the 2010 - 2012 timeframe. The costs and inventory impacts of this alternative were explored in the context of Option 4 in the NPRM.

8.3.1 Support for 15 ppm Locomotive and Marine Diesel Fuel in this Rule

Several commenters believe that we should impose more stringent sulfur standards to diesel fuel used in marine and locomotive engines in this rulemaking. They believe that the application of the proposed fuel standards to marine and locomotive engines will provide a significant benefit to public health since these engines comprise a significant portion of diesel emissions from the nonroad sector. STAPPA/ALAPCO added that the 500 ppm sulfur cap is inadequate and that we should adopt a fuel sulfur standard for locomotive and marine diesel fuel that would require 500 ppm fuel sulfur in 2007 and 15 ppm fuel sulfur by 2010. CATF supports the one-step approach, and suggested that we require ultra-low sulfur diesel fuel for marine diesel engines and locomotives by 2009 and should include this standard as part of the final rule.

In regards to public health concerns, the Sierra Club noted that since many railroad networks pass through lower income areas in Chicago and elsewhere, reducing emissions from locomotive sources will be important for ensuring environmental justice. ALA noted that this approach would provide much needed reductions in nonattainment areas and NRDC added that requiring 15 ppm sulfur levels in locomotive and marine diesel fuel would cut roughly 1,000 additional tons/year of diesel soot, and provide additional sulfate PM and SO_2 emission reductions with benefits that far outweigh the costs. Environmental Defense cited to the significant emissions contribution of these sources; locomotive engines comprise 27 and 10 percent of the nonroad diesel inventory for NO_x and PM2.5, respectively; and marine engines comprise 18 percent of the nonroad inventory for PM2.5. They added that marine vessels account for 48 tons per day of NO_x emissions in the LA basin and generally are a significant and undercounted source of air pollutants. Environmental Defense provided additional discussion on this issue, noting the significance of the emissions contribution and the quantity of marine fuel consumed. In addition, they offered supporting documentation: 1) Emissions from Waterborne Commerce Vessels in United States Continental and Inland Waterways, Environ. Sci. Technol. 2000, 34, 3254-3260, and 2) In-Use Marine Diesel Fuel, EPA420-R-99-027 (August 1999). In support of the application of the fuel sulfur standard to locomotive fuels, Environmental Defense cited report by the Southwest Research Institute, "Diesel Fuel Effects on Locomotive Exhaust Emissions," (October 2000, SRI 08.02062).

MECA and UCS believe that requiring a 15 ppm sulfur fuel for marine and locomotive engines would open the possibility for the use of advanced emission control technologies that are going to be used on other categories of nonroad and highway engines and would lead to significant NO_x and PM reductions. UCS also noted that locomotive and marine engines contribute approximately 22 percent of the PM and almost half of the NO_x emissions from nonroad engines.

The American Trucking Association commented that we should apply the 15 ppm standard to the marine and locomotive market, provided fuel availability, cost and purity are not negatively impacted. Further, NRDC and NY DEC specifically commented that requiring 15 ppm sulfur in locomotive and marine diesel fuel would require minimal additional investment by the oil industry, but would create significant economies of scale for refiners, would simplify the fuel distribution system and the overall design of the fuel program, and would minimize the potential for misfueling or supply problems. They believe that this approach will also make the proposed use of Solvent Yellow 124 or other marking technology superfluous, thus simplifying the baseline issue and streamlining the regulatory activities of refiners and EPA.

Letters:
American Trucking Association, OAR-2003-0012-0632 p. 6
Building and Construction Trades Dept., AFL-CIO, OAR-2003-0012-0674 - 0676 p. 2, 4
California Air Resources Board, OAR-2003-0012-0644 p. 7
Clean Air Council, OAR-2003-0012-0613 p. 2
Clean Air Task Force, et. al., OAR-2003-0012-0508 p. 15-16
Environmental Defense, OAR-2003-0012-0821 p. 11-13, 15-16
Illinois Lieutenant Governor Pat Quinn, OAR-2003-0012-0781 p. 5
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 10
Massachusetts Department of Environmental Protection, OAR-2003-0012-0641 p. 2
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 14

NESCAUM, OAR-2003-0012-0659 p. 11
New Hampshire House of Representatives, OAR-2003-0012-0126 p. 1
New York City Office of Environmental Coordination, OAR-2003-0012-0631 p. 2
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 14
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 3
Oregon Department of Environmental Quality, OAR-2003-0012-0779 p. 2
Pennsylvania Department of Environmental Protection, OAR-2003-0012-0699 p. 3
Regional Air Pollution Control Agency, OAR-2003-0012-0683 p. 2
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 11
San Joaquin Valley Air Pollution Control District, OAR-2003-0012-0695 p. 1-2
Texas Commission on Environmental Quality, OAR-2003-0012-0716, 0717 p. 1
Union of Concerned Scientists, OAR-2003-0012-0830 p. 4
U.S. Public Interest Research Group, OAR-2003-0012-0780 p. 2
Western Regional Air Partnership, OAR-2003-0012-0774, 0775 p. 2
Wisconsin Department of Natural Resources, OAR-2003-0012-0702, 0703 p. 3
92,308 Public Citizens
1,476 Public Citizens
New York Public Hearing
A-2001-28, IV-D-05 [ALA p. 112; ATA p. 169; CARB p. 141; CATF p. 238; ED p. 152; MECA p. 119; NESCAUM p. 99; NRDC p. 32; NY DEC p. 15; NY PIRG p. 133; OTC p. 214; STAPPA/ALAPCO p. 47; U.S. PIRG p. 188; W. Harlem EA p. 261]
Los Angeles Public Hearing
A-2001-28, IV-D-07 [ALA- LA p. 220; CARB p. 14; CERA p. 78; CAT p. 184; CBE p. 136; ED p. 93; LAF p. 254; MECA p. 61; NRDC p. 54; STAPPA/ALAPCO p. 29; U.S. PIRG p. 178; UCS p. 68]
Chicago Public Hearing
A-2001-28, IV-D-06 [ALA- Chicago p. 285; CATF p. 261; CAT p. 153; ELPC p. 251; MECA p. 48; NPS p. 214; OEC p. 293; STAPPA/ALAPCO p. 39; Sierra Club p. 167; SACE p. 183; U.S. PIRG p. 12]

Our Response:

We agree that a 15 ppm sulfur cap for locomotive and marine fuel would provide an important increase in the long-term PM and SO2 benefits of the rule. As described in Section 4 of the preamble, we believe that a 15 ppm sulfur standard for fuel used by locomotives and marine engines is technologically feasible and practical for refiners. We have determined that the full fuel program, including the 15 ppm sulfur standard for locomotive and marine fuel, is cost-effective, that the monetized benefits of even this last increment outweigh the costs, and that the costs do not otherwise warrant delaying this second step for locomotive and marine. It will also simplify the fuel distribution system and overall design of the fuel program.

Thus we are finalizing a 15 ppm standard for locomotive and marine fuel starting June 1, 2012, along with the nonroad diesel fuel standards starting June 1, 2010. However, given the complete program that we are finalizing today, there will still be a need for a fuel marker. 500 ppm sulfur small refiner and credit fuel will still be in the market until 2014. Offspec product in the distribution system not meeting a 15 ppm standard will also be permitted for sale to nonroad, locomotive, and marine markets until 2014, and to the locomotive and marine market after that. Heating oil will remain uncontrolled. A fuel marker will still be needed to identify fuel produced for heating oil purposes rather than nonroad, locomotive, or marine markets. It will also be needed to identify 500 ppm sulfur fuel produced or imported for the locomotive and marine market rather than the nonroad market, during 2010 - 2012. The marker will not be required in certain Northeast areas as well as Alaska, see section IV of the preamble for more discussion on this issue.

8.3.2 Oppose 15 ppm Standard for Locomotive and Marine Diesel Fuel

What Commenters Said:

A number of commenters believe that we should not impose more stringent fuel sulfur standards on fuel used for marine and locomotive engines in this rulemaking. They believe that sulfur reductions to locomotive diesel without the availability and application of the appropriate aftertreatment technology would provide negligible environmental benefits, and would adversely affect fuel supplies. API noted that a reduction in sulfur content to 15 ppm for locomotive and marine fuel without concurrent changes to engine standards that require the use of aftertreatment would be inconsistent with EPA's recent fuel/engine systems approach to emission reduction regulations. BP added that additional time will allow for further advances in hydrotreating technology, hydrotreating catalysts and sulfur removal techniques that may reduce the overall cost of desulfurization. Some commenters (AAR, API, BP, Marathon, BNSF, NPRA, Flint) also noted that the marine and locomotive market will provide a valuable outlet for higher sulfur distillate during upsets and turnarounds, and that tight distillate supplies would be exacerbated by requiring LM fuel to meet a 15 ppm sulfur standard.

The Association of American Railroads (AAR) and Burlington Northern Santa Fe Railroad (BNSF) commented that railroad engines do not currently use technologies that require the use of low sulfur fuel since the use of these technologies on locomotive engines is not practical. They add that locomotive engines are much larger and operate at a much lower engine speed than trucks and construction equipment, and further, these engines operate in narrow tunnels with little room for clearance and are often operated with the engines in trailing units that get very little air. As a result, emissions reducing engine technology from other engine families cannot always be transferred to locomotive engines with the same effectiveness. Emissions from the lower speed locomotive engines are not reduced through the use of low sulfur fuel to the same degree as for other higher speed nonroad engines. AAR and BNSF believe that due to the technological constraints and the minimal benefits that would result from the use of low sulfur fuel, we should not require the railroad industry to use 15 ppm diesel. They added that treating all diesel fuel users the same would cause the railroad industry to spend significantly more for fuel with minimal air quality benefits.

AAR and BNSF also asserted that the railroad industry is a relatively environmentally friendly form of transport on a ton per mile basis and has already taken action to reduce emissions from locomotive sources. They noted that the railroad industry has agreed to retrofit engines built after 1972 to reduce NO_x emissions 33 percent from the baseline non-regulated engines. In addition, BNSF and Union Pacific also have agreed to a fleet average in the SCAQMD, the only such agreement in the country and would represent a 100 percent scrappage program over a five-year period. They believe that imposing the 15 ppm standard on locomotive fuel is unnecessary and would lead to minimal environmental benefit.

AAR, BNSF, and GE Transportation Systems believe that imposing a standard absent a technology need would be disproportionately expensive. They added that using such cost-ineffective methods to reduce emissions from locomotives could exacerbate emissions and pollution overall by diverting business away from railroads, which are a relatively environmentally friendly mode of transport. GE also commented that there is no basis for concluding that such low sulfur fuel will be needed to meet Tier 3 locomotive emissions standards since EPA has not yet issued an ANPRM on these standards, and that even in the event that Tier 3 standards are adopted, the existing fleet would still not require aftertreatment and could be adversely affected by the use of low sulfur fuel.

GE further states that the use of low sulfur fuel (500 ppm or 15 ppm) in the absence of aftertreatment devices could actually lead to increased PM emissions. They provided additional discussion on this issue, noting that the testing conducted by SwRI cannot be used to conclude that the use of low sulfur diesel alone would reduce emissions since these data were based on only two locomotive types that are not representative of the entire fleet. (They cited "The Effect of Diesel Fuel Properties on the Combustion of a Medium Speed Diesel Engine," by Bertrand D. Hsu ad John G. Hoffman, Jr., presented at the Energy Sources and Technology Conference and Exhibition, Dallas, TX, February 17-21, 1985 to support this comment.)

GE also believes that a 500 ppm or 15 ppm sulfur standard for locomotive and marine diesel fuel is likely to compromise the reliability and performance of the engine, and in particular, will result in leaks in older locomotives. They noted that this was experienced when low sulfur fuels were introduced in the on-highway heavy duty truck industry. They stated that composition of higher sulfur fuel causes seals to expand over time and when lower sulfur fuel is introduced, the seals will contract leading to fuel leaks, which results in the locomotive being taken out of service, which could be very damaging to the railroad industry. GE provided additional discussion on this issue in their public comments and asserted that there is insufficient evidence to support the conclusion that locomotive engines can be fueled continuously with either 500 ppm or 15 ppm diesel fuel. Lastly, GE commented that our statement that reduced sulfur will actually save money by reducing oil change intervals does not apply to locomotives. (See related discussion under Issues 5.1 and 9.3.3.)

Finally, API and Marathon commented that EPA's cost estimates for reducing sulfur in locomotive/marine diesel fuel from 500 ppm to 15 ppm may not be accurate. They believe that EPA has arbitrarily split the incremental $1.8 billion in fuel costs between PM and SO2. Since the PM reductions under the proposal are more costly than SO2 reductions, a 4 to 1 prorating of the increased fuel costs might be more appropriate. This would result in a nearly $160,000/ton cost for PM and a $3,100/ton for SO2. Thus, the commenters stated, both incremental costs are at least 15 times larger than those in the proposal.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 2, 39
Association of American Railroads, OAR-2003-0012-0700, 0701 p. 1-3
BP, OAR-2003-0012-0649 p. 1
Chevron, OAR-2003-0012-0782 p. 1-2
ConocoPhillips, OAR-2003-0012-0777 p. 2
ExxonMobil, OAR-2003-0012-0616 p. 2, 9
Flint Hills Resources, OAR-2003-0012-0667 p. 4-5
Frontier Oil Corporation, OAR-2003-0012-0621 p. 1

General Electric Transportation Systems, OAR-2003-0012-0784 p. 1-8
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 1-2, 35
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 3, 13-14
Tesoro, OAR-2003-0012-0662 p. 1-2
Western States Air Resources Council, OAR-2003-0012-0711 p. 2
New York Public Hearing, A-2001-28, IV-D-05 [API p. 19; AAR p. 196; NPRA p. 83]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [API p. 41; BNSF p. 210]
Chicago Public Hearing, A-2001-28, IV-D-06 [API p. 86; BP p. 171; NPRA p. 18]
1 Public Citizen

Our Response:

As discussed in the preamble, we believe that extending that 15 ppm sulfur standard to locomotive and marine (LM) fuel is appropriate based on a full evaluation of the emission reductions achieved and the associated public health and welfare benefits, technological feasibility, and cost. Locomotives and marine engines contribute substantially to off-highway PM and SO_2 inventories as described in Section 3 of the RIA. For instance, the annual $PM_{2.5}$ emissions inventory from locomotive and marine engines is approximately 30% as large as the $PM_{2.5}$ inventory from nonroad engines. Likewise the annual SO_2 emissions inventory from locomotive and marine engines is approximately 40% as large as the SO_2 inventory from nonroad engines. Our program for NRLM fuel reduces more than 16,000 tons of $PM_{2.5}$ from nonroad engines and more than 6,000 tons of $PM_{2.5}$ from locomotive and marine engines in 2015, in addition to dramatic reductions in SO_2 from these engines. These environmental benefits are substantial and highlight the value for controlling emissions from these sources.

We are finalizing the 15 ppm sulfur standard for locomotive and marine diesel fuel, along with nonroad diesel fuel, for several reasons. First, it will provide important health and welfare benefits from the additional sulfate PM and sulfur dioxide emission reductions as early as possible. Second, it is technologically feasible, as it is for nonroad diesel fuel. Third, the benefits outweigh the costs and the costs do not otherwise warrant delaying this second step for locomotive and marine. Finally, it will simplify the fuel distribution system and overall design of the fuel program. We are not justifying the 15 ppm standard for LM fuel in this rulemaking on its value for enabling aftertreatment technologies in future locomotives. However, as described in our response to Issue 8.3.3, we plan to publish an Advanced Notice of Proposed Rulemaking soon describing our plans in this area. See Section IV.A of the preamble for additional discussion of our full justification for the 15 ppm standard for LM fuel.

The extension of the 15 ppm standard to LM fuel produces important public health and welfare value benefits. As shown in Chapter 8.7 of the RIA, the incremental reduction in fuel sulfur content from 500 ppm to 15 ppm in 2015 reduces $PM_{2.5}$ by more than 700 tons and SO_2 by more than 14,000 tons. While these reductions are a minor proportion of the reductions generated from the full program (approximately 53,000 tons $PM_{2.5}$ and 297,000 tons SO_2 in 2015), the reductions produce significant benefits which exceed the costs.

As described in Appendix 5.A, we have legal authority to control the sulfur content of LM fuel without concurrently setting new engine standards. EPA will explore the fuel/engine systems approach as in recent rulemakings as one way to maximize the environmental benefits of a program. However, a fuel-based standard is also an important approach to protect human health and the environment by reducing emissions from mobile source engines and vehicles. For example, the first step to 500 ppm sulfur for LM is not associated with new engine standards, and achieves important public health and welfare benefits. The second step to 15 ppm is also appropriate in this case. We do recognize that a 15 ppm LM standard may also enable aftertreatment for locomotives. Therefore, as described in our response to Issue 8.3.3, we plan to publish an Advanced Notice of Proposed Rulemaking soon describing our plans in this area. However, the 15 ppm standard for LM fuel in this rule is not based on enabling aftertreatment technology but is justified separately.

Some commenters argued that additional time is necessary in order to evaluate advanced hydrotreating technologies for producing 15 ppm locomotive and marine fuel. This rule will provide refiners and importers with more than eight years before they would have to begin complying with the 15 ppm cap for LM diesel fuel on June 1, 2012. Our lead time analysis, which is presented in the RIA, projects that 30-39 months are typically needed to design and construct a diesel fuel hydrotreater, perhaps less if it is a Process Dynamics unit.[44] Thus, refiners will have about five years before they would have to begin detailed design and construction. This lead time is fully sufficient for refiners to plan their operations.

Just over three quarters of the refiners likely to produce 500ppm sulfur NRLM diesel fuel in 2007 are already well into their planning for meeting the 15 ppm highway diesel fuel standard, effective June 1, 2006. Based on pre-compliance reports, we know that many refineries will be producing 100% of their diesel fuel to 15 ppm beginning in 2006, and thus will have demonstrated that maintaining a higher sulfur grade is not necessary to the successful operation of a refinery. It is likely that these refiners have already chemically characterized their high sulfur diesel fuel blendstocks, as well as their highway diesel fuel, for potential desulfurization. They will also have already assessed the various technologies for producing 15 ppm diesel fuel and have a good idea of how to design their 500 ppm sulfur NRLM hydrotreater to be revampable to meet the 15 ppm NR diesel fuel cap starting in 2010 and the 15 ppm LM diesel fuel cap starting in 2012. Additionally, the refiners producing 15 ppm NRLM fuel will be able to take advantage of the experience gained from the highway refiners, especially those NRLM producers who are able to defer complying with the program due to the use of credits or the small refiner provisions.

In evaluating the appropriateness of applying the 15 ppm sulfur standard to locomotive and marine fuel, we have projected that refiners would be making use of a combination of conventional and advanced desulfurization technology. Although it is true that delaying the requirement for 15 ppm LM fuel beyond 2012 might allow some more advanced desulfurization technologies to be implemented in the long run, it is also true that setting the standard now allows refiners to coordinate their desulfurization operations to apply to highway, nonroad, and LM fuel in parallel instead of doing them in series. This coordination is generally expected to increase efficiency and thus reduce costs.

Some commenters argued that a 15 ppm sulfur standard for locomotive and marine fuel will eliminate this portion of the distillate pool as an outlet for high sulfur distillate. We have addressed this concern through other means. The Northeast/mid-atlantic and Alaska heating oil markets will continue to provide such an outlet, and today's rule also provides that 500 ppm diesel fuel produced due to contamination and interface mixing in the distribution system can continue to be used in nonroad, locomotive, and marine equipment until 2014, and in locomotive and marine engines after that date

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[44] "Highway Diesel Progress Review," USEPA, EPA420-R-02-016, June 2002.

outside these areas. In response to concerns about offspec batches produced by refiners, we also considered allowing refiners to sell a small fraction of their diesel fuel production as 500 ppm without the use of credits in order to provide additional flexibility for offspec fuel. However, refiners informed us in discussions that such an option was not helpful. As a result, we are not finalizing such a provision. We note that refiners are still able to mitigate offspec batches through the use of credits and also have the option of downgrading offspec product to the heating oil market. These provisions ensure that there will be a sufficient outlet for refiners of such offspec diesel fuel during the first several years of the 15 ppm LM program. These provisions also serve to eliminate much of the need for refiners to otherwise reprocess offspec product, thereby maintaining refinery capacity and preserving overall supply. Additional discussion of the provisions that will help to ensure adequate supply can be found in Section IV.A of the preamble.

When EPA adopted a 15 ppm sulfur standard for highway diesel fuel, we included several provisions to ensure a smooth transition to 15 ppm sulfur highway fuel. One provision was a temporary compliance option, with an averaging, banking and trading component. In a similar manner, the 2012 deadline for 15 ppm sulfur LM fuel, the last, relatively small segment of diesel fuel, will help ensure that the entire pool of diesel fuel is smoothly transitioned to the 15 ppm sulfur level over a short period of time.

Setting a 2012 deadline for this relatively small remaining segment of regulated diesel fuel will allow refiners a limited period of additional time to ensure that their production processes are optimized for production of ultra low sulfur diesel fuel. During this time period, off spec production generated during upsets, turnarounds or other production problems can still be marketed by refiners as locomotive and marine diesel fuel. It will also allow a short period of additional time for completion of capital investments and the related scheduling of engineering and construction resources. In combination this has the potential to avoid unexpected pressures on fuel supply and to reduce costs somewhat. In sum, setting a 2012 deadline for production of this last portion of the pool of ultra low sulfur diesel fuel will help ensure a smooth transition by the refining industry to producing ultra low sulfur diesel fuel for the entire pool of regulated diesel fuel. For similar reasons, EPA is extending for two additional years the time period in which early credits may be used. This affects only the time period in which such credits can be used, not the generation of such credits.

GE's assertion that PM emissions from locomotives could increase as a result of using 15 ppm sulfur fuel is based on theoretical combustion impacts that, if true, would apply to any diesel engine. However, GE did not present any data to support the concept that PM emissions would in fact increase, for locomotives or other nonroad engines. In addition, GE made reference to a study by Hsu and Hoffman that show decreases in PM emissions when fuel sulfur content was reduced. We continue to believe, based on the information available to us, that reductions in sulfur content of diesel fuel will result in reductions in PM in locomotive engines, in particular through the reduction of sulfate PM. In addition, we do not believe that the emission benefits of low sulfur are significantly different for low speed locomotives than for higher speed nonroad engines. All fuel sulfur reductions manifest as a combination of sulfate PM and SO_2 emission reductions, and the rate of those emission reductions is a function of the fuel consumption rate. Slower speed engines tend to have lower specific fuel consumption than higher speed engines, but this potential difference between locomotives and other engines has already been taken into account in the inventories. Also, the fraction of sulfur which becomes sulfate PM, as opposed to SO_2, should be largely independent of the speed of the engine. Thus we continue to believe that the PM benefits of the 15 ppm standard should be essentially the same, on a per gallon basis, for locomotives and nonroad engines.

Regarding the concern about seal shrinkage due to the use of 15 ppm fuel, we note that seal shrinkage is tied most specifically to aromatics levels, not sulfur. Reductions in sulfur using conventional desulfurization technologies do often result in some reductions in aromatics, but advanced desulfurization technologies may have little or no impact on aromatics. Most nonroad engines, including locomotives manufactured or rebuilt since the introduction of the 500 ppm sulfur standard have been designed to tolerate lower sulfur levels. As described in the proposal, we believe that no issues with leaking fuel pump O-rings would occur with the changes in diesel fuel sulfur levels contained in this final rule because while we do believe PNA content will be reduced, we are not predicting it will achieve the near-zero level experienced in California where the leaks cited by the commenter usually occurred. Furthermore, we note that the issue about seal leakage is not unique to a decision to control locomotive and marine fuel to 15 ppm sulfur. See our discussion about seal leakage in nonroad engines at Issue 3.10.3, since the seal leakage issue for nonroad engines is essentially the same as the seal leakage issue for locomotive and marine engines.

Given the limitations of the distribution system today, a significant portion of fuel used in locomotives is produced to the 500 ppm highway standard. In the future this spillover will be 15 ppm fuel, as acknowledged by representatives from AAR in face-to-face conversations. We estimate that even without a 15 ppm standard for locomotive and marine fuel, 17% would be 15 ppm anyway. Thus any concerns about the use of 15 ppm diesel fuel in locomotives with regard to seal leakage would have arisen even in the absence of a 15 ppm standard for LM fuel.

Regarding oil change intervals for locomotives, we have estimated the extension of oil-change intervals realized by 500 ppm sulfur fuel in 2007 and the additional extension resulting from 15 ppm sulfur fuel in 2012. These estimates are based on our analysis of publically available information from nonroad engine manufacturers, and our conclusions regarding average cost reductions from lengthened oil change intervals recognize that some engines may have higher cost savings while other engines will have lower cost savings. We estimate that reducing fuel sulfur to 500 ppm will reduce engine wear and oil degradation to the existing fleet of nonroad diesel engines, as well as locomotive and marine diesel engines. Reducing fuel sulfur to 15 ppm will further reduce engine wear and oil degradation. The types of benefits expected are shown in Table 6.2-28 in the preamble, and Table 6.2-29 includes our full analysis of the cost reductions associated with reduced oil change intervals for locomotives. We did not receive any comments which questioned our analysis or the factors used in it.

GE referenced a 1993 study discussing deterioration of insolubles in locomotives, but only concluded that insolubles could increases if the engine timing was retarded. We do not consider this comment to be directly germane to the impact of reduced sulfur on oil change intervals, since it mixes fuel changes with engine calibration changes. Therefore, we continue to believe that it is appropriate to estimate increases in oil change intervals for locomotives when 15 ppm sulfur fuel is introduced.

In response to API and Marathon's comment regarding the cost effectiveness of reducing fuel sulfur from 500 ppm to 15 ppm, we note that because the new fuel and engine emission standards will reduce emissions of several different pollutants (i.e., NOx, PM, NMHC, and SOx), we have attempted to allocate the various estimated costs to emission reductions of specific pollutants (this is discussed in more detail in Chapter 8 of the RIA). This apportionment of costs by pollutant allows us to calculate the average cost per ton of emission reduction resulting from this rule. Table 8.1-2 of the RIA summarizes the allocations we have used in the final rule. Deciding how to apportion costs can be difficult even in the case of technologies that, on the surface, seem to have an obvious split by which their costs should be attributed. For instance, we have apportioned 100 percent of the cost for CDPF technology to PM even though CDPFs are expected to reduce NMHC emissions significantly. For fuel-related costs in the context of evaluating emissions reductions based solely on the fuel control and not on new engine emission standards, the costs for the reduction of uncontrolled sulfur levels to 15 ppm in a two-step process have been apportioned one-third to PM and two-thirds to SOx. This is different than the allocation of costs for the proposed program where we allocated 100 percent of the cost of uncontrolled to 500 ppm to SOx control, but is consistent with how we allocated costs for the 500 ppm to 15 ppm LM increment in the proposal.

We believe that our one-third/two-thirds allocation used in the final rule and the proposal's analysis of the 15ppm LM increment is the most appropriate method. The lower sulfur fuel provides for substantial PM and SOx reductions, even without new engine standards, and although about 98 percent of fuel borne sulfur is exhausted as SOx, and only two percent is exhausted as PM, the PM reductions have much higher human health benefits relative to SOx reductions. The 33/67 split between PM/SOx that we have chosen to use throughout the final rule provides the most appropriate balance while recognizing that there is no single split that is clearly right and others clearly wrong. The 4-to-1 prorating of fuel costs suggested by API assumes that PM reductions resulting from fuel sulfur reductions are more costly than SOx reductions. We do not believe this is a valid basis for assigning costs to the two pollutants. Since this assumption presumes a priori that $/ton values for PM are very different from $/ton values for SOx when reductions in both pollutants come about through a single action, namely reductions in fuel sulfur content, the assumption appears to assume the answer to the question being asked and thus is not appropriate.

Table 8.7-15 in the RIA summarizes the cost-effectiveness estimates for our full engine + fuel program, as well as various fuel-only components. The incremental $/ton values for lowering the sulfur standard from 500 ppm to 15 ppm for LM fuel are somewhat high compared to other programs controlling PM or SOx emissions, as shown in Tables VI.D-4 and VI.D-6 of the preamble. However, the monetized health and welfare benefits of the incremental 15 ppm LM fuel standard exceed the costs. In addition, it is more appropriate to evaluate the overall fuel program, as that is what is being adopted, and the $/ton values for the overall fuel program, including the 15 ppm sulfur standard for LM fuel, are much lower. The entire body of evidence strongly supports the view that controlling sulfur in NRLM fuel to 15 ppm, through a 2-step process, is quite reasonable in light of the emissions reductions achieved, taking costs into consideration.

8.3.3 Support More Stringent Locomotive and Marine Standards in a Separate Rulemaking

What Commenters Said:

A number of commenters support more stringent emission standards for marine and locomotive diesel engine, however they believe that this should take place in a separate rulemaking. These commenters support imposing more stringent standards for these engines because of the significant air quality benefits. The Illinois Lt. Governor added that regulating these sources will provide an additional incentive for developing advanced emission reduction technologies. Further, the San Joaquin Valley Air

Pollution Control District recommended that as part of the proposed nonroad rule, we should commit to an additional rulemaking and timely schedule for implementing locomotive and marine standards. Some commenters (BP, API, NPRA) noted that the fuel should be regulated through a systems approach.

EMA commented that we should defer the question of when and whether to require 15 ppm sulfur fuel for locomotive and marine engines to a future rulemaking. They believe that requiring locomotive and marine engine users to use 15 ppm commercial fuel when it is not needed to meet emission requirements creates an economic burden with no environmental benefit. They also stated that maintenance of the 500 ppm sulfur fuel limit for these engines will help ease the transition to 15 ppm sulfur fuel. Finally, EMA commented that we should conduct separate locomotive and marine rulemakings rather than a single rulemaking covering both applications, noting that beginning discussions and fact finding on these rules starting in 2004 would be an appropriate timeframe. However, they do not believe that an ANPRM is a necessary step in this rulemaking process, rather that EPA should work with EMA on the development of these rules.

NRDC and UCS further commented that this additional rule should reduce PM emissions by 90 to 95 percent, consider the feasibility of requiring aftertreatment-based NO_x standards; and take effect no later than 2012. They believe that this rule can be justified given the large contribution of these engines to the PM and NO_x inventory and the potential growth in the locomotive and port sectors. They also cited the ports of L.A. and Long Beach as examples of why more stringent standards for marine and locomotive engines are important, as these ports and the nonroad marine and locomotive engines, operate near homes and schools and provide a significant health risk to the public.

Along with NRDC, WRAP believes that we should accelerate the schedule for an additional rulemaking that would address emissions from locomotives and marine diesel engines. They commented that the program should be proposed by the end of 2003, so that stakeholders may review and comment on the proposal prior to the finalization of the Tier 4 rule, and believe that it is unclear why three years would be needed to complete this rulemaking. WRAP added that these standards should be promulgated no later than 2007 so that the benefits of such standards could be included in SIPs for regional haze (under section 308), the 8-hour standard, and the PM2.5 standard.

CATF commented that we should substantially tighten the existing standards for locomotive and marine engines. They added that the difference between the marine and locomotive standards and the Tier 4 nonroad standards is more than a full order of magnitude. Commercial marine standards are 18 to 27 times the numerical level of the Tier 4 nonroad standards, and locomotive standards are even less stringent, from 19 to 54 times the numerical level of the Tier 4 standards. They provided additional discussion on this issue that compares both Tier 3 and Tier 4 standards versus locomotive and commercial marine engine emission standards. CATF also noted that the latter are inconsistent with the CAA mandate of setting standards to provide the greatest possible reductions, and recommends that we require these engines to comply with Tier 4 standards as soon as possible.

Lastly, API and Marathon commented that when ultra-low sulfur diesel is needed for new locomotive and marine engine emission standards, desulfurization costs may ultimately be lower as more cost-effective process technologies continue to evolve. API does not support the required use of 15 ppm fuel in LM engines until EPA determines the need for and establishes emission standards requiring the application of aftertreatment technologies that need 15 ppm fuel.

Letters:
American Trucking Association, OAR-2003-0012-0632 p. 6
California Air Resources Board, OAR-2003-0012-0644 p. 7
Clean Air Task Force, et. al., OAR-2003-0012-0508 p. 16-20
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 8
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 92-93
Environmental Advocates of NY, OAR-2003-0012-0523 p. 2
Illinois Lieutenant Governor Pat Quinn, OAR-2003-0012-0781 p. 6
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 10
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 14-16
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 11-12
San Joaquin Valley Air Pollution Control District, OAR-2003-0012-0695 p. 2
Texas Commission on Environmental Quality, OAR-2003-0012-0716, 0717 p. 2
Union of Concerned Scientists, OAR-2003-0012-0830 p. 7
Western States Air Resources Council, OAR-2003-0012-0711 p. 2
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 14-15
Western Regional Air Partnership, OAR-2003-0012-0774, 0775 p. 2
39,736 Public Citizens
1,159 Public Citizens
New York Public Hearing
A-2001-28, IV-D-05 [ATA, p.169; CAT p. 238; MECA p. 119; STAPPA/ALAPCO p. 47]
Los Angeles Public Hearing
A-2001-28, IV-D-07 [ALA p. 220; CARB p. 14; NRDC p. 54]
Chicago Public Hearing
A-2001-28, IV-D-06 [ALA- Chicago p. 287; CATF p. 262; OEC p. 293]

Our Response:

We are planning a separate rule to implement new emission standards for locomotive and marine diesel engines. We plan to publish an Advanced Notice of Proposed Rulemaking soon describing our plans in this area. The rationale for our decision to finalize the 15 ppm standard for locomotive and marine fuel in today's final rule is contained in our response to Issue 8.3.2 and in section IV of the preamble.

8.4. Other Program Options

8.4.1. Extended Use of 500 ppm Diesel Fuel in >750 hp Engines Employed by the Mining Industry

What Commenters Said:

Murphy Oil Corporation requested that EPA consider allowing >750 hp engines employed by the taconite mining industry to use 500 ppm sulfur nonroad diesel fuel until such a time as the aftertreatment for these engines which requires 15 ppm sulfur fuel is shown to be viable and economical. Murphy also expressed concern regarding the viability of emissions aftertreatment technology for engines over 750 hp such as those used in the taconite mining industry. Murphy included a case study on the potential adverse economic impacts of today's rule on the taconite industry in its comments. Based on this study, Murphy stated that the emissions benefits from lowering nonroad diesel fuel from 500 ppm to 15 ppm for taconite mining equipment would not justify the cost.

Letters:
Murphy Oil Company, OAR-2003-0012-0212

Our Response:

Issues related to the aftertreatment-based standards for >750 hp engines are addressed in chapter 3 of this S&A document. The emissions standards in today's rule will require that such engines be equipped with PM traps after 2014. We deferred finalizing a NOx standard under today's rule for such engines which would have required the use of NOx aftertreatment equipment. However, we intend to revisit this issue in a later rulemaking.

Today's rule provides that 500 ppm diesel fuel may continue to be used in all nonroad engines manufactured before 2011 until May 31, 2014. Starting June 1, 2010 when the 15 ppm sulfur standard for nonroad diesel fuel becomes effective, 500 ppm nonroad diesel fuel may be produced by qualifying small refiners or through the use of credits, or may be generated from reprocessed transmix or segregated interface in the distribution system. Thus, for several years the taconite mines can continue to use 500 ppm nonroad diesel fuel if their equipment allows it and they can find a supplier. However, after the refiner flexibility provisions expire the taconite mines, like all other nonroad diesel fuel consumers must switch over to the use of 15 ppm diesel fuel. We discontinued the allowance for the use of 500 ppm diesel fuel in pre model year 2011 nonroad engines after 2014 in order to achieve the intended environmental benefits of the program. Extending these refiner flexibilities (and allowing nonroad engine operators to continue to use higher sulfur fuel) were not necessary to implement the program and would have reduced the emission benefits. Allowing continued use of higher sulfur fuel would also have increased concerns regarding the potential for misfueling of post MY-2011 aftertreatment-equipped nonroad engines.

Although the timetable for implementation of the emissions standards for >750 hp engines lags that for other nonroad engines, we believe that it would be inappropriate to extend the allowance for the continued use of 500 ppm diesel fuel in >750 hp engines beyond the May 31, 2014 implementation date for the 15 ppm sulfur standard applicable for nonroad diesel fuel used all nonroad diesel engines. Requiring that all nonroad engines must use 15 ppm diesel fuel after 2014 will ensure attainment of the full environmental benefit of today's rule and will substantially reduce the chance for misfueling of aftertreatment equipped nonroad engines.

Chapter 2 of the preamble to today's rule discusses the reasons why we are finalizing a national program rather than exempting certain areas from today's requirements based on the status of their attainment with air quality standards. Section 7.2.1. of this S&A discusses why we are not conducting an analysis of the impacts on sub-sectors of the industries regulated by today's rule, such as the taconite mining industry.

9. REQUIREMENTS FOR ENGINE AND EQUIPMENT MANUFACTURERS

What We Proposed:

The comments in this section correspond to Section VII of the NPRM. A summary of the comments received, as well as our response to those comments are located below. For the full text of comments summarized here, please refer to the public record for this rulemaking.

9.1 Averaging, Banking, and Trading

9.1.1 General Comments

9.1.1.1 Commenters Conditionally Support the Proposed ABT Program

What Commenters Said:

CARB and STAPPA/ALAPCO expressed support for the ABT program provided the generation of credits is verifiable and enforceable, provided detailed discussion of the proposed ABT program, and acknowledged their agreement with EPA's approach on a number of ABT program provisions. STAPPA/ALAPCO specifically noted that traditionally they have had concerns with ABT programs since: 1) they have not demonstrated significant cost reductions for the mobile source sector; 2) they have not been transparent to the public due to confidentiality issues; and 3) the increased flexibility can increase the complexity of the program, potentially reducing emissions benefits. STAPPA/ALAPCO also acknowledged that EPA has taken steps to address these concerns and generally agrees with the approach.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 7-8
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 20-22
New York Public Hearing, A-2001-28, IV-D-05 [CARB p. 141]

AGCA commented that it supports the ABT program provided EPA promotes flexibility for engine and equipment manufacturers and allows affected parties some decision-making role in activities that are required to meet the standards.

Letters:
Associated General Contractors of America, OAR-2003-0012-0791 p. 12

Our Response:

We agree with the commenters and are adopting an ABT program applicable to the Tier 4 program. We believe the credits generated under the ABT program will be verifiable and enforceable. In addition, we believe the program is an aspect of the lead time necessary to comply with the standards, and will provide engine manufacturers with significant flexibility as they strive to meet the Tier 4 standards for their entire product range.

9.1.1.2 Manufacturers Should Be Able to Fully Use the ABT Credits That They Have Generated

What Commenters Said:

DDC and EMA commented that EPA should not retroactively devalue credits that have already been generated or used. The commenters further stated that the value in a well-crafted ABT program is the certainty that manufacturers will be able to continue to invest in technologies and rely on reasonable and cost-effective provisions for generating and using credits in meeting the standards.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 5
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 34-36, 112

DDC and EMA commented that EPA has proposed that credits earned by engines certifying to the previous NO_x + NMHC standard (i.e. Tier 2/3) be discounted by 20 percent when used on engines certifying to the Tier 4 NO_x only standards. This violates current Part 89 regulations which allow undiscounted NO_x + NMHC credits earned for Tier 2 and later engines to be used in subsequent model years. EPA indicates that this discount is necessary because of the change from a NO_x + NMHC standard to a NO_x only standard. However, even though the "phase-out" engines will likely have very low NMHC emissions by virtue of having a PM filter, it cannot be characterized as a "windfall." EPA's concern in this context is more appropriately resolved by rejecting the phase-in/phase-out concept and simply adopting interim averaged standards for NO_x, NMHC, CO, and PM. In this case, the credits earned by interim engines would be NO_x-only and should be transferable to other families on a NO_x-only basis without any concern of a NMHC windfall. [See related discussion under Issue 3.1.1.]

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 5
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 38, 112

DDC and EMA commented that discounting credits earned by engines certifying to the previous NO_x + NMHC standards cannot be justified by assuming that this approach would provide a net environmental benefit. Attempts to restructure ABT for the purpose of providing direct environmental benefits will undermine the original purpose of the program and will result in a program that manufacturers have little or no incentive to use. The approach of devaluing credits would be inconsistent with the CAA since it would undermine the feasibility and cost effectiveness of the proposed standards.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 5
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 39, 112

EMA commented that EPA has engaged in an unconstitutional taking by eliminating the life of averaging, banking and trading credits which were guaranteed by EPA not to expire in its prior rulemakings on the Tier 2 and 3 standards. The commenter also stated that EPA has violated the prior commitment made in its regulations, and has engaged in an illegal, unconstitutional taking of engine manufacturers' property and other rights.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 109, 112

CNH Global commented that EPA should not reduce the value of emission credits by setting arbitrary caps on family emission limits. Emission credits were generated in good faith by accelerating the introduction of reduced emission engines on the basis that these credits would always be available as provided in the Statement of Principles that formed the basis of the Tier 2 and Tier 3 regulation.

Letters:
CNH Global, OAR-2003-0012-0819 p. 8

CEMA-CECE commented that as part of the ABT provisions, EPA should allow for more credits to be carried over from previous years.

Letters:
CEMA-CECE, OAR-2003-0012-0598 p. 4

Our Response:

With respect to the comments disputing our proposal to apply a 20 percent discount factor to NOx + NMHC Tier 2/3 credits, we note first that no commenter challenged our rationale that a factor of 20 percent reasonably accounts for the NMHC portion of the credit. Because the mix of NMHC and NOx emissions will vary from engine family to engine family, there is no exact number to account for NMHC of all engines. For this program we believed the 20 percent value was a good estimate and noted in the proposal that there would be a small benefit to the environment (i.e., a small discount) by adjusting every NMHC+NOx credit by 20 percent. Commenters also did not dispute (and indeed agreed) that use of PM aftertreatment would necessarily result in low NMHC emissions, so that NMHC reductions for phase-out engines would just be a by-product of a means of emission control that would be used in any case. (Indeed, for this reason, calling the 20 percent adjustment a 'discount factor' is something of a misnomer; it is an allocation of the portion of emission reduction that would occur for phase-out engines in any event.) Thus, the factual premise of EPA's action is essentially undisputed.

We thus continue to believe that allowing unadjusted credits for these NMHC reductions, including incidental NMHC reductions, is inappropriate. Use of the ABT program is an aspect of selecting an appropriate lead time for the Tier 4 standards under section 213(b). Extension of Tier 4 lead time based on use of credits that are generated incidentally to use of Tier 4 PM control technology would not be appropriate. This is because the Tier 4 effective date would be extended for engines using such engines past "the earliest possible date" on which Tier 4 NOx control could be applied based on a windfall credit for NMHC reductions that would occur in any case.

Commenters further argued that EPA's proposal was bad policy because EPA had guaranteed the future use of credits (in this case, NOx and NMHC credits) generated by Tier 2/3 engines. The commenter even asserts that EPA was engaged in an unconstitutional taking of property rights. The premise to these comments is misplaced. In the first place, when an agency adopts rules, it can always amend those rules provided it has a reasoned basis to do so and provides due process in the form of notice and opportunity for comment (amply provided for in this rulemaking). Second, in any case, this rulemaking is establishing a new set of engine standards, not revisiting the Tier 2/3 standards. In developing a new rulemaking, we necessarily must evaluate the provisions of previous rules and their potential impact on the future standards being considered. This rulemaking is determining the greatest emission reduction of NOx achievable through application of available technology , as required by section 213 (a) (3) of the Act, and standards implementing that determination must take effect at the earliest possible date the control technology can be developed and applied, as required by section 213 (b). EPA believes that delaying use of engines equipped with NOx aftertreatment through use of credits generated for NMHC reductions, and in some cases incidental reductions, is inconsistent with these mandates. It would postpone available reductions based on reductions (largely incidental) of a different pollutant.

The commenter further suggests that credits already generated are being devalued. As EPA explained at proposal, however, the most likely source of the NMHC potential windfall credit would be a 2011 engine equipped with Tier 3 NOx controls but installing Tier 4 PM controls (i.e., a phase-out engine). This is a situation involving prospective (potential) credit generation, not already-generated credits. More basically, the only decision EPA made in the Tier 2/3 rule was that credits generated by Tier 2/3 engines could be used indefinitely to show compliance with the Tier 2/3 rule, not with future rules. EPA did not, and could not, decide in the Tier 2/3 rulemaking that Tier 2/3 credits could be used to show compliance with some future standard that had not yet even been adopted. That is the issue presented for the first time in this rulemaking. EPA reasonably proposed that using credits in the form of NOx + NMHC reduction to show compliance with a NOx-only standard calls for determining how much of the NOx + NMHC credits represent NOx reductions, and only using that portion for purposes of NOx credits. This is additionally supported by the fact that NMHC reductions for phase-out engines are not ‘extra’ reductions above and beyond what would otherwise occur, and therefore do not represent reductions that warrant use as a credit.

Several commenters opposed the various provisions which affect the ability to use previous tier credits in the Tier 4 timeframe (i.e., discounts applied to NMHC+NOx credits used for NOx demonstration, restrictions on the use of previous tier credits in the Tier 4 timeframe, and the tight FEL caps applied to Tier 4 which limit the ability to use credits in an unfettered manner). As explained at proposal, we believe that these provisions consistently implement a reasonable approach whereby ABT provisions are used to promote expeditious transition and attainment of new, stringent standards, and are not used to unnecessarily continue producing old-technology higher-emitting engines. See 68 FR at 28467. Our approach is wholly in keeping with the technology-forcing nature of section 213 (a) (3), as well as consistent with the requirement in section 213 (a) (4) that standards be appropriate, considering, among other things, application of available control technology.

Finally, as to the commenter’s suggestion that EPA not adopt the NOx phase-in/phase-out approach, and instead adopt interim averaged standards, EPA notes that it is providing the option of complying with interim, averaged standards during the phase-in period. See Preamble section II.A.2.b. However, we are retaining the phase in/phase-out compliance path as well, as it provides a potential means of encouraging introduction starting in 2011 of very low-NOx engines.

9.1.1.3 EPA Should Allow for the Transfer of Credits from Tier 3 Engines to Demonstrate Tier 4 Compliance, but Only If the 20 Percent Discount Is Applied

What Commenters Said:

CARB commented that in addition, the final rule should maintain the 20 percent discount that would apply to HC+NO_x credits generated on the less than 75 hp engines and used for averaging purposes with the NO_x standards for engines greater than 75 hp.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 7-8

Our Response:

We agree that the 20 percent "discount" for the use of NMHC+NOx credits to demonstrate compliance with a NOx-only standard is appropriate. For reasons described in more detail in section III.A. of the preamble for the Tier 4 final rule, we are retaining the 20 percent discount applied to NMHC+NOx credits used for demonstration of compliance with the Tier 4 NOx-only standards. (As noted in the previous response, moreover, we regard the 20 percent adjustment as an appropriate adjustment to assure that only NOx reductions generate NOx credits. Because the mix of NMHC and NOx emissions will vary from engine family to engine family, there is no exact number to account for NMHC of all engines. For this program we believed the 20 percent value was a good estimate and noted in the proposal that there would be a small benefit to the environment (i.e., a small discount) by adjusting every NMHC+NOx credit by 20 percent.)

9.1.1.4 EPA Should Not Allow for the Use of Tier 1 or Tier 2 ABT Credits to Demonstrate Tier 4 Compliance

What Commenters Said:

NRDC commented that EPA should restrict the use of Tier 1 and 2 credits in the Tier 4 ABT program since these credits were generated from engines that are certified to much higher certification levels than future Tier 4 engines; allowing the use of these earlier credits in the Tier 4 program could significantly delay the implementation of the final Tier 4 program and its benefits.

Letters:
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 28

STAPPA/ALAPCO commented that it supports EPA's proposal to allow for the use of credits from Tier 4 engines or from engines certified to the previous tier of standards for Tier 4. The commenter also noted that it supports the proposed provisions for engines between 75 and 175 horsepower which will allow the use of credits from Tier 2 engines if the manufacturer complies with the 50 percent phase-in requirement in 2012 and 2013 but not allow the use of credits from Tier 2 engines between 75 and 175 hp under the reduced phase-in option.

Letters:
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 21

Our Response:

We agree in general with the comments that credits from engines certified to much higher certification levels than future Tier 4 engines should not be allowed to demonstrate compliance with the Tier 4 standards. Therefore, as proposed, we are adopting provisions that allow the use only of previous tier credits to demonstrate compliance with the Tier 4 standards. This will allow manufacturers to use Tier 2 credits for engines below 50 horsepower and engines above 750 horsepower (because there are no "Tier 3" standards for these power categories), and Tier 3 credits for engines between 50 and 750 horsepower.

The final ABT provisions include two exceptions to this general principle. First, as proposed, manufacturers will be allowed to use Tier 2 credits in the 75 to 175 horsepower category if they choose the 50 percent phase-in option for 2012 and 2013 but not if they choose the reduced (25 percent) phase-in option. Second, because our 2008 model year Tier 4 standards for engines between 50 and 75 horsepower supplant the current Tier 3 standards (unless a manufacturer opts to delay compliance with the Tier 4 standards until 2012), manufacturers will be allowed to use credits generated from Tier 2 engines between 50 and 100 horsepower to demonstrate compliance with the Tier 4 standards in the 50 to 75 horsepower power range if they choose to demonstrate compliance with the pull-ahead 2008 Tier 4 standards for 50 to 75 horsepower engines. We believe this is consistent with our provisions to allow the use of previous tier credits for demonstration with the Tier 4 standards. Manufacturers that do not choose to comply with the 2008 Tier standards for engines between 50 and 75 horsepower and instead comply with the 2012 Tier 4 standards for such engines will not be allowed to use Tier 2 credits in Tier 4, but instead will be allowed to use Tier 3 credits as allowed under the standard provisions regarding use of previous-tier credits only for Tier 4 compliance demonstration.

9.1.1.5 EPA Should Adopt a 25 Percent Discount for All ABT Credits to Help Ensure That the Program Provides a Net Environmental Benefit

What Commenters Said:

NRDC commented that EPA should adopt a 25% discount for all ABT credits to help ensure that the program provides a net environmental benefit, but provided no further discussion or supporting documentation.

Letters:
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 28

Our Response:

We believe the Tier 4 standards are sufficiently stringent to justify allowing manufacturers to claim full credit for any reductions of emissions below the standards. In addition, we believe a general discount applied to all Tier 4 credits would diminish the incentive to reduce emissions below the standards, and also could result in insufficient lead time for complying with the Tier 4 standards by reducing the availability of ABT as a means of demonstrating compliance. Therefore, we are not requiring any general discount of credits earned from Tier 4 engines.

9.1.1.6 EPA Should Maintain a Requirement for Periodic Reports That Summarize the Use of the Proposed ABT Program by Engine and Equipment Manufacturers

What Commenters Said:

NRDC recommended that quarterly reports be required, while STAPPA/ALAPCO noted that EPA should commit to annual reports.

Letters:
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 28
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 20

Our Response:

We agree with the commenters that reports on the use of the ABT program should be issued by EPA. As discussed in the proposal, we intend to issue an annual report summarizing use of the ABT program by manufacturers. While one of the commenters suggested quarterly reports, we believe annual reports make the most sense. Under the ABT regulations, engine manufacturers are required to submit an annual report to EPA regarding their use of the ABT program. These final reports must be submitted no later than 270 days after the close of the model year and must include the number of credits generated or required in the previous model year, the number of credits banked by the manufacturer, and a copy of any contracts related to the trading of credits. Since the reports are required on an annual basis, we believe it makes sense for EPA to issue a summary report of the information supplied by manufacturers (summarized in a way that protects the confidentiality of information submitted by individual engine manufacturers) on an annual basis.

9.1.2 Family Emission Limit (FEL) Caps

9.1.2.1 Commenter Supports the Use of FEL Caps in this Rulemaking

What Commenters Said:

STAPPA/ALAPCO commented that EPA should maintain the proposed FEL caps, since they are consistent with those set in previous rulemakings.

Letters:
STAPPA/ALAPCO , OAR-2003-0012-0507 p. 20-21

CARB commented that it supports the alternate FEL caps.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 7

Our Response:

See "Our Response" in the following section (Issue 9.1.2.2) for a response to these FEL cap comments.

9.1.2.2 EPA Should Not Impose FEL Caps since the Zero-sum Requirement of ABT Will Ensure That There Are No Adverse Emission Impacts

What Commenters Said:

CNH Global, DDC, and EMA commented that an ABT program provides engine manufacturers with important flexibility and ultimately results in lower costs of compliance. From an emissions inventory perspective, it is irrelevant whether one engine is ten units above the standard or ten engines (of the same useful life and power level) are one unit above the standard. An especially important use of ABT is where a manufacturer does not have sufficient resources to complete development of all its engine families covered by a given Tier change. In this case, it is often beneficial to earn credits on some families by producing engines calibrated to achieve emission levels that are below the standards in the years leading up to the Tier change and use these credits to spread the work load and defer meeting the new standards on some engine families. However, by imposing an arbitrary FEL cap that is less than (i.e., more stringent than) the previous standard, EPA eliminates the possibility of using this important strategy and forces manufacturers to conduct two phases of development, thus increasing costs without providing any environmental benefit. EMA also noted that if FEL caps are imposed, they should be established at the level of the previous standards and that it is too early to tell if the alternate FEL caps will be sufficient.

<u>Letters:</u>
CNH Global, OAR-2003-0012-0819 p. 8
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 5
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 36-38, 112

Our Response:

For the final rule, EPA is adopting the FEL caps as proposed, with some exceptions for engines above 750 horsepower where we are adopting different standards than originally proposed and for phase-in engines between 75 and 750 horsepower where we have adopted an option for manufacturers to certify to alternative standards during the phase-in period. We continue to believe that it is important to ensure that technology turns over in a timely manner and that manufacturers do not continue producing large numbers of high-emitting, old technology engines once the Tier 4 standards become fully effective. For the Tier 4 standards, where the standards are being reduced by an order of magnitude, we believe this goal to be particularly important, and in keeping with the technology-forcing provisions of section 213(a). It simply would not be appropriate to have long-term FEL caps that allowed engines to indefinitely have emissions as high as ten times the level of the standard. Section III.A. of the preamble contains a complete description of the Tier 4 FEL caps and a detailed discussion of our rationale for adopting the FEL caps contained in the final program.

It should be noted that, in response to the comment above regarding perceived need to carry over previous tier engines in some circumstances, we are adopting provisions that allow manufacturers to produce a limited number of 75 to 750 horsepower engines for a limited period of time that are certified with FELs as high as the level of the standards that applied in the year prior to the new standards. See 40 CFR 1039.104(g). This will provide flexibility to manufacturers to produce limited number of engines meeting the previously applicable standards while ensuring that the large majority of engines are certified at levels near the Tier 4 standards.

9.1.3 Averaging Sets

9.1.3.1 Commenters Support EPA's Proposal to Include All Power Categories in a Single Averaging Set

What Commenters Said:

DDC and EMA commented that since the credit calculations weight the credits by production volume, power level and useful life, there is no risk of environmental loss from using a single averaging set. The commenters believe that this approach provides the best opportunity for engine manufacturers to properly manage resources.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 5
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 39, 112

Our Response:

Our proposal did include all power categories in a single averaging set. However, a number of changes have been made to the final Tier 4 program for engines above 750 horsepower that have caused us to place a restriction on the exchange of Tier 4 credits across the 750 horsepower threshold. Therefore, all engines below 750 horsepower will be included in one averaging set for the Tier 4 program. All engines above 750 horsepower will be included in a separate averaging set for Tier 4. We believe this approach to averaging sets is appropriate for the reasons set out in section III.A. of the preamble.

9.1.3.2 Commenter Expresses Concern Regarding the Elimination of the Averaging Set Restriction

What Commenters Said:

Yanmar commented that the equation for the emission credit calculation uses the average power of the engine family and the useful life. Thus, engine families with a larger average power and/or longer useful life can generate sizeable emission credits. This creates an unfair situation between the manufacturers with a full line-up and those with a more limited line-up of smaller output engines. Yanmar also noted that it generally supports the proposal but that EPA should establish a restriction or barrier at 56 kW to account for the fact that averaging should only be made within the engine families to which technology transfer from on-highway engines can or cannot easily be made.

Letters:
Yanmar, OAR-2003-0012-0615, 0813 p. 7

Our Response:

We disagree with the commenter that separate averaging sets are needed for engines above and below 75 horsepower. For the reasons described in section III.A. of the preamble we are adopting a single average set for engines below 750 horsepower in the Tier 4 program.

9.1.4 Inclusion of Credits from Retrofit of Nonroad Engines

9.1.4.1 EPA Should Allow for Credit Generation by Retrofitted Nonroad Engines

What Commenters Said:

EMA commented that a program that would allow for credit generation by retrofitted nonroad engines would serve to increase engine manufacturers' flexibility in meeting the standards and would also help minimize costs. Expanding the ABT program will increase the potential to develop and implement low-emission technology earlier than would otherwise be required. EMA further commented that EPA should work with manufacturers to develop such a program but to do so as part of this rulemaking would be premature.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 39-40, 112

MECA commented that EPA should allow manufacturers to retrofit diesel particulate filters on nonroad engines. The diesel particulate filter retrofit credit program will provide an important opportunity to expand the experience and build interest in retrofitting nonroad engines. This program could serve as the catalyst for promoting other initiatives to retrofit additional nonroad equipment with exhaust emission control technology. However, MECA noted, EPA should ensure that the credits are fully enforceable and verifiable.

Letters:
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 11

WRAP commented that a retrofit program to generate credits that manufacturers can use for compliance purposes will help reduce emissions from existing nonroad engines, provided the program ensures that credits are verifiable, quantifiable, and enforceable. The commenter further stated that the 20 percent discount on retrofit credits will help ensure the program's integrity in this respect, but EPA should also address other issues and should involve the WRAP in the design and implementation of such a program.

Letters:
Western Regional Air Partnership, OAR-2003-0012-0774, 0775 p. 2

Our Response:

We are not adopting a retrofit credit program with the Tier 4 final rule. Although we provided a detailed explanation of a potential program at proposal (see memorandum referenced at 68 FR 28471, footnote 299), we believe it is important to more fully consider the details of a nonroad engine retrofit credit program and work with interested parties in determining whether a viable program can be developed. EPA intends to explore the possibility of a voluntary, opt-in nonroad retrofit credit program through a separate action in the future.

9.1.4.2 Commenters Support Retrofit Programs Generally but Express Concern with the Use of Retrofit Credits in the Proposed ABT Program

What Commenters Said:

NRDC, STAPPA/ALAPCO, and the Texas Commission on Environmental Quality commented that retrofit programs can provide cost-effective emission reductions from the existing nonroad fleet, which is especially important because of the long useful life of nonroad engines. However, the ABT program is not the best vehicle for promoting diesel retrofit programs, since it will be difficult to determine whether the credits are surplus, verifiable, quantifiable and enforceable. The proposal does not address how retrofits are used in the real world, and adds new layers of complexity to an already complex ABT program. Lastly, the commenters stated that there does not appear to be any verifiable way to estimate how many hours the equipment is being used or the scope of the emission reductions.

<u>Letters:</u>
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 26-28
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 18
Texas Commission on Environmental Quality, OAR-2003-0012-0716, 0717 p. 2

NRDC and STAPPA/ALAPCO further commented that if EPA includes a retrofit program, a discount of 25 percent should be applied to any ABT retrofit credits that are used to meet nonroad standards.

<u>Letters:</u>
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 27-28
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 18

NESCAUM commented that typically, in a retrofit project, a number of steps are needed to ensure emissions reductions are achieved. First, temperature data on machines must be gathered to make sure that engines are suitable for retrofit. Second, an assessment of machine activity over time must be completed to ensure that duty cycles will not change dramatically after retrofit. Third, actual installation of the devices must be completed. Finally, oversight to make sure that any required maintenance of the devices is being carried out is necessary. It remains unclear how EPA will ensure that these elements are accounted for in a retrofit program that provides credits. Before final promulgation, EPA should make a clear demonstration that any potential retrofit credit program will actually achieve its desired goal.

<u>Letters:</u>
NESCAUM, OAR-2003-0012-0659 p. 10

CARB commented that EPA should allow for banking and trading from retrofitted nonroad diesel engines only if the credit generation is verifiable and enforceable. If retrofit credits are allowed, the credit banking program should limit the number of credits granted to nonroad engines that are already subject to separate retrofit requirements. EPA's proposal to devalue credits from retrofitted engines by 20 percent could help ensure a balance between the emissions reducing potential of a retrofitted engine versus a new engine over their respective lifetimes. In this context, EPA must develop a robust tracking procedure for all credits, which may require a large amount of resources and expertise to develop and manage. EPA should be realistic in its expectations in this regard and should consider all relevant details before permitting such a wide-ranging ABT program.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 8
New York Public Hearing, A-2001-28, IV-D-05 [CARB p. 140]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [CARB p. 18]

Environmental Defense commented that EPA should ensure that any emission reductions associated with retrofit credits are quantifiable, verifiable, and fungible. EPA should be rigorous in designing a sensible program since it will address a variety of different engines functioning in divergent operating conditions.

Letters:
Environmental Defense, OAR-2003-0012-0821 p. 18

Our Response:

As noted in "Our Response" to issue 9.1.4.1 above, we are not adopting a retrofit credit program with the Tier 4 final rule. We believe it is important to more fully consider the details of a nonroad engine retrofit credit program and work with interested parties in determining whether a viable program can be developed. EPA intends to explore the possibility of a voluntary, opt-in nonroad retrofit credit program through a separate action in the future.

9.1.4.3 EPA Should Not Allow for Emissions Trading Between New and Old Engines

What Commenters Said:

The Union of Concerned Scientists commented that there is little information available on the real-world use and emissions of older diesel equipment, and enforcement of "paper trades" could prove to be extremely difficult. The infrastructure is insufficient to ensure that trading will not result in an adverse impact to public health and the environment. Also, allowing for trading between these sources could slow the development of advanced aftertreatment technologies for nonroad equipment.

Letters:
Union of Concerned Scientists, OAR-2003-0012-0830 p. 10
Los Angeles Public Hearing, A-2001-28, IV-D-07 [UCS p. 71]

The Ozone Transport Commission (OTC) and a number of public citizens expressed opposition to trading between new and old engines, noting that allowing credits for retrofits will cause some problems in terms of being able to keep track of emission reductions. OTC also noted that when older equipment is retrofitted, it requires careful attention since it may not lead to expected results, and that before allowing trades between new engines and older retrofitted engines, EPA should carefully evaluate the potential impact this approach would have on the overall nonroad emissions inventory.

Letters:

New York Public Hearing, A-2001-28, IV-D-05 [OTC p. 213]

Our Response:

As noted in "Our Response" to issue 9.1.4.1 above, we are not adopting a retrofit credit program with the Tier 4 final rule. We believe it is important to more fully consider the details of a nonroad engine retrofit credit program and work with interested parties in determining whether a viable program can be developed. EPA intends to explore the possibility of a voluntary, opt-in nonroad retrofit credit program through a separate action in the future.

9.1.4.4 EPA Did Not Include in its Analysis Engine Retrofit Requirements and Costs

What Commenters Said:

Commenters representing agricultural interests noted that EPA did not include engine retrofit requirements and costs in its analysis of the rule. One commenter is concerned that the availability of only ultra-low sulfur diesel fuel would force farmers to retrofit existing equipment, adding millions of dollars of costs on the agricultural sector and in many cases imposing costs that exceed the value of the equipment. Another expressed concern over whether old engines will eventually be mandated to be replaced by newer engines.

Letters:
American Farm Bureau Federation, OAR-2003-0012-0608
Idaho Wheat Commission, et al., OAR-2003-0012-0645
Illinois Farm Bureau, OAR-2003-0012-0673
Kansas Farm Bureau, OAR-2003-0012-0825
Michigan Farm Bureau, OAR-2003-0012-0625
Nebraska Farm Bureau, OAR-2003-0012-0514
Tennessee Farm Bureau, OAR-2003-0012-0629

Our Response:

As noted in "Our Response" to issue 9.1.4.1 above, we are not adopting a retrofit credit program with the Tier 4 final rule. We believe it is important to more fully consider the details of a nonroad engine retrofit credit program and work with interested parties in determining whether a viable program can be developed. EPA intends to explore the possibility of a voluntary, opt-in nonroad retrofit credit program through a separate action in the future.

9.1.4.5 EPA Should Rely on Market Mechanisms to Determine Retrofit Technology

What Commenters Said:

One commenter felt EPA should rely on the market to determine the appropriate technology available for achieve PM emissions reductions. The commenter felt imposing a discount and designing a program which required specific technology would preclude marketplace innovation and felt this seemed to be an indication that the Agency was prejudging "the best way to achieve the goal rather than letting" the " end user find the most cost-effective manner." The commenter further stated that "by limiting yourself to post-combustion technology you are further reducing the pool of potential participants."

Letters:
Lubrizol, OAR-2003-0012-1019

Our Response:

As noted in "Our Response" to issue 9.1.4.1 above, we are not adopting a retrofit credit program with the Tier 4 final rule. We believe it is important to more fully consider the details of a nonroad engine retrofit credit program and work with interested parties in determining whether a viable program can be developed.

9.1.5 ABT Tracking Requirements

9.1.5.1 Nonroad Engine Manufacturers Should Not Be Penalized for the Difficulty of Tracking Engines in the Nonroad Marketplace

What Commenters Said:

DDC and EMA commented that nonroad engines often are produced in a single location and then distributed to equipment manufacturers worldwide, who in turn, sell their equipment worldwide through complex distribution channels. It is generally very difficult and costly for engine manufacturers to track the first point of retail sale. However, manufacturers can track a substantial number of these engines and should be allowed to make reasonable projections without incurring significant penalties that would negate much of the value of the ABT program simply because they are unable to track their full production. EMA specifically recommended that EPA adopt a specific formula for use in projecting the number of engines to be used in the ABT credit calculation equations and provides a summary and detailed description of the suggested formula and its variables, which has a built-in penalty associated with incomplete tracking. This formula will ensure that manufacturers use "due diligence" in their tracking efforts and get "fair value" for their credits, and that all counts are projected in the same manner.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 5
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 34-36, 112

Our Response:

EPA has issued guidance setting out one potential means of estimating credits generated by on-highway heavy-duty engines. EPA recognizes that the nonroad diesel market is complex and that various types of estimation methodologies may be appropriate for determining (in the language of the rule) when a manufacturer has conducted an adequate level of tracking to the point of first retail sale - i.e. to the point where the engine in the equipment is introduced for commercial use. EPA plans to issue additional guidance on this issue for nonroad engines, taking into account that the nonroad diesel engine market lacks the direct, integrated supply chain associated with the on-highway heavy-duty diesel engine market, and the more dispersed nonroad diesel distribution network has the potential to limit the effectiveness of credit tracking mechanisms commonly used for on-highway diesel engines.

9.1.6 Other ABT Issues

9.1.6.1 The ABT Provisions Should Be Expanded to Include CO Standards

What Commenters Said:

DDC and EMA commented that traditionally, CO emissions from diesel engines have been well below applicable standards. However, with full aftertreatment, new engine technologies and the higher costs of introducing new products, ABT will most likely be necessary not only for PM and NO_x + NMHC standards but also for CO standards.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 6
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 39, 112

Our Response:

In the Tier 4 proposal, we proposed minor changes in CO standards for some engines solely for the purpose of helping to consolidate power categories and improving administrative efficiency. However, manufacturers objected to these proposed changes, citing technological feasibility concerns, and a lack of parity with highway diesel and nonroad spark-ignition engines. Because we proposed the CO standard changes for the sake of simplifying and consolidating power categories, we have withdrawn this aspect of the proposal. We do note, however, that we are applying new certification tests to all pollutants covered by the rule, the result being that Tier 4 engines will have to certify to CO standards measured by the transient test (including a cold start component), and the NTE. However, as shown in RIA chapter 4 (see, e.g., RIA 4.1.1.2 and note F), we believe that application of Tier 4 technologies will lead to a reduction in CO emissions over the Tier 3 baseline. See also Response to Comment 3.2.5. We thus believe the CO standards will be readily achievable under the transient test and the NTE. Moreover, we believe that there will not be any associated costs: the CO standards can be met without any further technological improvements (i.e., improvements other than those already necessary to meet the Tier 4 standards) and these tests will already be used for certification. Since CO standards measured by the new certification tests are achievable without cost, there is no basis for allowing ABT because no additional lead time is needed.

9.1.6.2 EPA Should Incorporate Hearing Provisions as Part of the ABT Provisions

What Commenters Said:

EMA commented that the ABT provisions in 1039.701 do not include any hearing provisions, and do not make reference to the hearing provisions contained in 1068.601. Hearing provisions should be included, consistent with the provisions in 89.212. Merely imposing the hearing provisions contained in 40 CFR 86.1853-01 is not acceptable, since this section does not contain any information on how a public hearing is requested, the Administrative procedures for a public hearing, and the hearing procedures.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 107, 112

Our Response:

We agree that hearing provisions should be included in the ABT provisions of 40 Part 1039.701 as exist in the current ABT regulations in 40 Part 89.212. The hearing provisions were inadvertently left out of the proposed regulations. The final ABT regulations of 40 Part 1039 have been revised to include hearing provisions.

9.1.6.3 EPA Should Allow Credits to Be Granted under the ABT Program for Electric Drive Technologies

What Commenters Said:

EPRI commented that EPA should consider amending the proposed rule to reward electric drive mobile technologies for contributing to overall emissions reductions. Forklifts, industrial tow tractors, sweepers, scrubbers, varnishers, airport bag tugs and belt loaders are nonroad vehicles rated at 25 hp or greater and have electric drive products that should be included in the proposed ABT flexibility mechanism or some other flexibility mechanism. In addition, there are smaller electric drive nonroad technologies that are available, including golf carts, burden and personnel carriers, turf trucks and lawnmowers. EPA should consider granting surplus emission credits to these sources since it would be cost effective (i.e. providing emission reductions at zero dollars per ton).

Letters:
Electric Power Research Institute, OAR-2003-0012-0772 p. 1

Our Response:

Section 213 requires EPA to develop standards that result in emission reductions from nonroad engines. The Clean Air Act defines a nonroad engine as ". . . an internal combustion engine (including the fuel system) that is not used in a motor vehicle or a vehicle used solely for competition . . ." Because electric motors are not internal combustion engines, any reductions from those engines would not be from a nonroad engine, and, conversely, a nonroad engine using credits generated by something other than a nonroad engine would not be reducing its emissions. We consequently do not see how this commenter's proposal is consistent with the language of section 213.

9.2 Original Equipment Manufacturer (OEM) Transition Provisions

9.2.1 General Flexibility Provisions

9.2.1.1 Commenters Support the Proposed Flexibility Provisions

What Commenters Said:

CARB, AGCA, and John Deere commented that they support the proposed flexibility provisions. CARB specifically commented that the equipment flexibility provisions are reasonable, but it is important not to lose ground on emission reductions by 2010.

Letters:
Associated General Contractors of America, OAR-2003-0012-0791 p. 10, 12
California Air Resources Board, OAR-2003-0012-0644 p. 8
New York Public Hearing, A-2001-28, IV-D-05 [Deere p. 56]

Our Response:

We agree with the commenters and are adopting flexibility provisions for equipment manufacturers as part of the Tier 4 program as an aspect of providing appropriate lead time for equipment manufacturers.

9.2.1.2 Instead of the Flexibility Program, EPA Should Specify a Made Available Date

What Commenters Said:

Ingersoll-Rand commented that the equipment manufacturers will need additional flexibility beyond what is currently proposed, since implementation of the proposed rule will require a significant degree of coordination between engine and equipment manufacturers. The highly integrated design approach between the engine and the equipment is likely to lead to delays in the transition to Tier 4. The TPEM is inadequate since EPA has not provided tangible relief to equipment manufacturers beyond what is already available under the current rule. EPA should modify the proposed rule to include provisions that provide a definitive period of lead time for incorporation of diesel engines into nonroad equipment. These modifications should include mandated lead time for equipment manufacturers. In the absence of sufficient lead-time, equipment manufacturers cannot know in advance the compliance status for each of their equipment models. To address this issue, the rule should specify a "made available" date before which each engine supplier must provide technical and performance specifications, complete drawings, and a final compliant engine to EPA and the open market. The performance specifications should include details on engine configuration, heat rejection, noise, fuel consumption, torque, and vibration. For a non-vertically integrated equipment manufacturer, "lead time" should begin when an engine supplier delivers this information. After the "made available" date, equipment manufacturers should be provided a minimum of 18 months of lead time to incorporate the new engines into nonroad equipment, which is essential for the redesign, performance testing and production of equipment that accommodates the new engines. This alternative is consistent with the explicit provisions of the CAA because it will achieve full compliance with the proposed standards at a reduced cost and with less market interference. Ingersoll-Rand also recommended that non-integrated equipment manufacturers receive one early compliance credit for early Tier 4 engine use.

Letters:
Ingersoll-Rand, OAR-2003-0012-0504 p. 14-16
New York Public Hearing, A-2001-28, IV-D-05 [IR p. 226]

Our Response:

We disagree with Ingersoll Rand's premise that Tier 4 will create a situation where expanded equipment maker lead time is the norm rather than the exception so that the rule must provide a drastic expansion of equipment manufacturer lead time. We believe that the lead time provided for equipment makers in this rule is adequate, and that the equipment maker flexibilities we are adopting provide a reasonable and targeted safety valve to deal with isolated problems. There is no across-the-board problem necessitating a drastic expansion of equipment-manufacturer lead time, or a drastic expansion of equipment manufacturer flexibilities. See section III.B.2 of the preamble and additional information placed in the docket for this rule. (See "Tier 4 Nonroad Diesel Equipment Flexibility Provisions," memo from Byron Bunker, Philip Carlson, and Cleophas Jackson., (EPA) to Docket OAR-2003-0012.)

One reason we do not believe that a drastic increase of equipment manufacturer lead time is warranted is because we do not see that the design and engineering challenges facing equipment manufacturers will be significantly more extreme than in the Tier 2/3 rule. Beyond making generalized assertions of extreme challenges posed by the rule, the commenter was largely unspecific about the type of engineering problems an equipment manufacturer could face; their public comments do refer without specifics to issues related to engine configuration, heat rejection, noise, fuel consumption, torque and vibration. In later letters to EPA, and in face-to-face meetings with agency personnel, the commenter also expressed concern regarding the potential for "late hits", situations where engine makers change a critical design element at a late stage in the development process, affording equipment manufacturers inadequate opportunity to make necessary design changes. After careful evaluation, we in fact believe that Tier 4 engineering challenges are likely to be more predictable and less likely to necessitate late changes in the equipment design process. The Tier 2/3 rule has led to (or is expected to lead to) redesign to accommodate new aftercooling, large radiators, large fans, and different engine configurations. Late changes in these components could necessitate fundamental equipment redesign. In Tier 4, redesigns will be necessary to accommodate PM filters, NOx adsorbers, and DOCs. Although redesign efforts to accommodate these aftertreatment components may be comparable to Tier 2/3 in terms of engineering time and effort, and amount of sheet metal needed, the size and shape of the catalyst technology will be well defined (due among other things to utilization in highway applications) well before start of production (we expect approximately 24 months before production, based on our discussions with engine and equipment manufacturers). Moreover, while late fine tuning of the engine or catalyst design will change emission characteristics, it will not change the size and shape of the catalysts, the things equipment manufacturers need to accommodate. EPA is thus reasonably confident that equipment manufacturers will be able to receive the necessary design information well in advance (we estimate about 24 months) so that they can begin their design efforts with ample lead time.

We have a number of specific reasons for rejecting the commenter's suggestion of a made available date. First, it is in both parties' interest for new engines and new equipment applications to reach the market expeditiously, so engine makers and equipment manufacturers usually adopt concurrent engineering programs whereby the new equipment design process occurs simultaneous to the new engine development process. Having EPA establish an arbitrary made available date insinuates EPA into this process in ways that are both unnecessary and counterproductive. We recognize that in some instances with small volume equipment manufacturers, the extent of early design involvement may differ. We have seen no instance where the small volume flexibilities are incapable of addressing this. We prefer to allow existing market mechanisms to function smoothly without arbitrary government directive. We also believe that the 18-month lead time following a made available date entails a mandated 18-month period (at least) with no return on investment to engine suppliers (i.e. the period between when the Tier 4 engine would be produced and when it could lawfully be sold), which would increase the engine cost, and discourage design changes (since such changes would entail more investment with delayed return on that investment). The ultimate result would be a costlier rule and less environmental benefit due to the delay in introducing Tier 4 engines. Even were EPA to put forth such a regulation, it is not clear that it could be enforced or that it would help the situation. It would only be natural for an engine manufacturer to continue to improve their products even after the predefined "made available date" and that equipment manufacturers would want to use this improved product even if it meant they had to make last minute changes to the equipment design. For EPA to preclude engine manufacturers from changing their product designs over the period between the certification date and the equipment manufacturer date would be both unusual and counterproductive to our goal of seeing the best possible products available in the market.

We do, however, believe that there could be individualized situations where extreme technical or engineering hardship could necessitate further lead time for equipment manufacturers. We are adopting a provision to provide for a case-by-case expansion of lead time (in the form of increased percent of production allowance or small volume allowance) to deal with these situations. See additional responses in this section of the S & A document. Ingersoll-Rand has informed EPA, by letter, that this provision satisfies all of the concerns expressed in their comments and follow-up meetings regarding adequacy of lead time for equipment manufacturers to meet Tier 4 standards.

9.2.1.3 EPA Should Reduce or Eliminate the Number of Flexibility Options for Engines less than 25 hp

What Commenters Said:

CARB commented that engines less than 25 hp will not require the flexibilities that the greater than 25 hp engines may need because they are not required to meet the more challenging aftertreatment-based standards. In fact, CARB noted, many of the less than 25 hp engines already meet the Tier 4 standards proposed by EPA.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 8

Our Response:

We disagree with the commenter that flexibilities are not needed for engines below 25 horsepower. While it is true that the Tier 4 standards for engines below 25 horsepower are not aftertreatment-based, we believe there will be changes in engines design for many of those engines in response to the Tier 4 standards. As engine designs change, there is the potential for impacts on equipment design as well. Therefore, we believe providing equipment manufacturer flexibility for engines below 25 horsepower is appropriate and we are including most of the flexibilities for engines below 25 horsepower as we are for the other power categories.

9.2.1.4 The Proposed Allowances Do Not Provide Adequate Flexibility for Manufacturers of Engines Greater than 750 hp

What Commenters Said:

EMA commented that expanded flexibility is very important to ensure the feasibility of the standards for engines greater than 750 hp. EPA should ensure that there is sufficient flexibility in the rule so that all of these larger engines would not need to have aftertreatment devices by the implementation date. The industry should have more time to develop and apply the appropriate technology. Allowing for only 80 percent of one year's production to be deferred is simply not adequate to provide the necessary flexibility and lead time for this category. EMA also commented that the small volume allowance also needs to be expanded.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 23-24

Our Response:

The Tier 4 standards being adopted today for engines above 750 horsepower have been revised from the proposal. We believe that these revisions have appropriately accommodated concerns for the most difficult to design applications (i.e., NOx adsorbers for engines in mobile applications), so that additional equipment flexibilities for engines above 750 horsepower are not warranted. We are adopting most of the flexibilities for engines above 750 horsepower as we are for the other power categories.

9.2.1.5 EPA Should Allow Trading of Flexibilities Across Power Categories

What Commenters Said:

Ingersoll-Rand commented that EPA should allow for allowances under the flexibility program to be traded across horsepower categories using proper weighting factors. In addition, EMA commented that, to make the Tier 4 standards feasible, EPA should allow equipment flexibility credits from the TPEM program to be exchanged by and between the two power categories that EPA currently has proposed for the 50 to 175 horsepower range.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 10
Ingersoll-Rand, OAR-2003-0012-0504 p. 16

Our Response:

EPA proposed flexibility allowances based on the view that the introduction of the Tier 4 standards in each power category could trigger the need for implementation flexibility for the equipment manufacturers using those engines. Expanding the exemption allowance in any power category by letting a manufacturer use exemptions it did not need in another power category would run contrary to this approach, and could create competitive inequities between companies that produce equipment over a broad range of the power categories versus companies that produce equipment in a limited power range. Perhaps more importantly, allowing such use across power categories could potentially provide more lead time than necessary. For these reasons, we are not adopting provisions to allow equipment manufacturers to trade their flexibilities across power categories in the Tier 4 program. We do note, however, that by having fewer categories in this rule as compared to Tier 2/3, we are effectively expanding the opportunities to use the flexibilities under the percent of production allowance, since there is a wider range of engines within each power category compared to Tier 2/3. (As noted elsewhere in this document, we are adopting an incentive program for equipment manufacturers to encourage the use of early Tier 4 engines that will provide extra allowances under the percent of production allowance and small volume allowance options. Under some limited circumstances, manufacturers will be allowed to transfer these extra allowances earned for early Tier 4 engine introduction across two power categories. Because these extra allowances are being earned for early introduction of Tier 4 engines, we believe some extra flexibility with those allowances should be allowed.)

With regard to the comment on the need to target the ability to trade allowances in the power categories encompassing the 50 to 175 horsepower engines to ensure feasibility of the Tier 4 standards, we believe the Tier 4 standards being adopted today are feasible (as discussed in section II.B. of the preamble for the final rule) and changes to the flexibility provisions are not necessary to ensure the feasibility of those standards.

9.2.1.6 Early Compliance Credits Should Be Granted for Each Certified Engine That a Non-vertically Integrated Equipment Manufacturer Incorporates into Equipment Prior to the Applicable Compliance Date

What Commenters Said:

Ingersoll-Rand commented that under this approach, each early compliance credit should be valid for the use of a previous-tier engine for 18 months after the certification date applicable to that engine. Early compliance credits could be used across product lines and hp categories, and proper weighting factors will be used when credits are exchanged across hp categories. Adoption of a credit-based system for early compliance by equipment manufacturers is appropriate given EPA's decision to provide numerous compliance alternatives to engine manufacturers, including ABT programs.

<u>Letters:</u>
Ingersoll-Rand, OAR-2003-0012-0504 p. 16

Our Response:

We agree with the thrust of this comment. The final rule therefore includes a provision whereby equipment manufacturers can receive additional flexibility allowances for early use of Tier 4 compliant engines. The details of this provision are set out in section III.B.2.e. of the preamble to the final rule and in 40 CFR 1039.627.

9.2.1.7 Early Use of Tier 4 Flexibilities in the Tier 2/3 Timeframe

What Commenters Said:

CARB commented that, regarding the use of Tier 4 flexibilities in the Tier 2/3 timeframe, the proposed 10 percent limitation would amount to a fraction of a ton lost in $HC+NO_x$ benefits in 2010. This restriction should be maintained provided the effect on existing emissions regulations remains negligible. In addition, CARB stated, EPA should discount any equipment flexibility used retroactively to further discourage abuse of this practice and ensure a proportionately larger and quicker roll-out of Tier 4 compliant equipment.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 8

Our Response:

We believe the provisions to allow equipment manufacturers to use a limited number of their Tier 4 flexibilities early will have a negligible effect on Tier 2/Tier 3 compliance because we have significantly limited the number of Tier 4 allowances a manufacturer could use early. Therefore, we are retaining the provisions as proposed. In response to the comment on discounting the use of early Tier 4 credits, we are not adopting such a discount. The intent of allowing manufacturers to use the Tier 4 flexibilities early was to allow them to carry over the few remaining equipment models that might not have been redesigned at the end of the seven year Tier 2/Tier 3 flexibility period until Tier 4 begins (see 68 FR at 28474), and not requiring a possible double redesign in a short period of time. Because we have placed a relatively low cap (10 percent) on the amount an equipment manufacturer could use early from Tier 4, we do not believe that manufacturers will be able to abuse the program and therefore should not have to discount the number of Tier 4 flexibilities used early. We also believe that allowing earlier use of Tier 4 flexibilities will result in earlier introduction of Tier 4 engines, id., and so believe that for this additional reason a discounting of such early use is not appropriate.

9.2.1.8 EPA Should Revise the Flexibility Allowances for Nonroad Equipment Meeting the Existing Tier 2/Tier 3 Standards

What Commenters Said:

DDC and EMA commented that the seven year period associated with the Tier 2/3 equipment flexibility program should be extended as necessary to eliminate the gap between the expiration of the Tier 2/3 flexibility program and the implementation of the Tier 4 standards. In addition, they noted, manufacturers should be allowed to continue using their Tier 2/Tier 3 flexibilities during this extended period.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 5
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 28-29

Ingersoll-Rand commented that EPA should provide additional flexibility allowances for nonroad equipment meeting the existing Tier 3 standards. Replenishing the allowances is necessary and reasonable because of the difficulties that equipment manufacturers will face when Tier 3 takes effect in 2006. In certain power categories, Ingersoll-Rand has used most or all of the 80 percent of production allowances during implementation of Tier 2, and other manufacturers likely face a similar situation. This situation provides little or no flexibility allowances to address lead time issues when Tier 3 standards take effect. Therefore, noted Ingersoll-Rand, EPA should provide additional allowances for Tier 3 by fully replenishing the 80 percent allowance for each power category.

Letters:
Ingersoll-Rand, OAR-2003-0012-0504 p. 18

Our Response:

Because this rule covers compliance with the Tier 4 program only, we do not believe it is appropriate to make changes to the existing Tier 2/Tier 3 flexibility program. EPA did not reopen any substantive feature of the Tier 2/3 rule for comment, and is not reconsidering this aspect of the Tier 2/3 program. These comments thus are not appropriate for this Tier 4 rulemaking. (We do note, however, that the rule provides for some early use of Tier 4 flexibilities, which would allow their use for a limited number of Tier 2/3 engines (see 68 FR at 28474 and section III.B.2.d of the final preamble, as well as the previous response), thus avoiding the type of gap about which EMA expressed concern.)

9.2.1.9 EPA Should Clarify Who Is Eligible to Use the Flexibility Provisions

What Commenters Said:

EMA and CNH Global commented that Section 1039.625 of the proposed rule limits the requirements for an equipment manufacturer to apply for flexibility "only if you have the primary responsibility for designing and manufacturing the equipment and install the engine in the equipment." Section 89.102 of the current regulation states the requirements for flexibility but does not provide a definition for equipment manufacturer. The proposed Tier 4 definition would exclude contracted manufacturer volume from inclusion in a flexibility plan even if the manufacturer is providing its own engines. EPA should address issues regarding variations associated with equipment manufacturing in the proposed rule, which could entail allowing equipment manufacturers that sell and service nonroad equipment to sub-contract manufacturing to other companies.

Letters:
CNH Global, OAR-2003-0012-0819 p. 7-8
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 31

Our Response:

We recognize that there are many different types of relationships between equipment manufacturers. However, we believe it is important to establish firm criteria for determining eligibility to use the equipment manufacturer allowances. We are concerned that the change to the equipment manufacturer definition suggested by the commenters would allow entities that have little or no involvement in the actual design, manufacture and assembly of equipment (e.g., companies that only import equipment) to claim they contracted with an equipment manufacturer to produce equipment for them and therefore claim allowances. This is the exact situation we are attempting to prevent with the changes to the eligibility requirements for the allowances. Therefore, we are retaining the requirement that only those nonroad equipment manufacturers that install engines and have primary responsibility for designing, and manufacturing equipment will qualify for the allowances or other relief provided under the Tier 4 transition provisions. However, we are revising the provisions regarding which engines an equipment manufacturer may include in its total count of U.S.-directed equipment production, which in turn affects the number of allowances an equipment manufacturer may claim. Under today's action, an equipment manufacturer may include equipment produced by other manufacturers under license to them for which they had primary design responsibility. This should allow cover the type of situation described by the commenters while preventing an import-only entity from claiming they are an equipment manufacturer and thereby gaining access to the allowances.

9.2.1.10 Commenter questions whether engine manufacturers will produce engines for the Tier 4 flexibility program and whether small businesses will be able to take advantage of the program.

What Commenters Said:

The SBA Office of Advocacy noted that during the SBREFA process, some small equipment manufacturers commented that although EPA would allow some equipment to be sold which would not require new emissions controls, these manufacturers believed that engine manufacturers would neither produce nor sell such engines. SBA Office of Advocacy also commented that EPA has not shown that substantial numbers of (small) businesses have taken advantage of previous small business flexibilities, or that small businesses would be able to take advantage of the flexibilities under this rule

Letters:
U.S. Small Business Administration Office of Advocacy, OAR-2003-0012-0815 - 0818 p. 11-12

Our Response:

The flexibility program adopted for Tier 4 will allow engine manufacturers to produce engines that do not meet the Tier 4 standards if an equipment manufacturer requests such engines for the flexibility program, similar to the current Tier 2/3 flexibility program. The experience with the current Tier 2/3 program leads us to believe that engine manufacturers will indeed produce such engines. Based on information provided by engine manufacturers to EPA under the requirements of the current Tier 2/3 flexibility program, engine manufacturers have sold substantial numbers of exempted engines to significant numbers of equipment manufacturers. For example, in the 300 to 600 horsepower category, we estimate that nearly 20 percent of the annual engine sales were exempted engines in the first year of the Tier 2/3 flexibility program. Those engines were sold to nearly 150 different equipment companies, many of which are small equipment manufacturers. To the extent that an engine manufacturer has a customer with a need, and it is possible for them to meet that need under the regulations, we believe that engine manufacturers will do everything possible to maintain their customer base. There has been no indication given by engine manufacturers that they intend to discontinue their practice of providing previous tier engines under the Tier 4 flexibility program. In fact, engine manufacturers have supported provisions that will allow them the ability to produce engines meeting the previous tier standards under the Averaging, Banking and Trading (ABT) program. Their support for this provision, leads us to believe that they are intending to produce some engines meeting the previous tier of standards without regard for the terms of the flexibility program.

In addition, the nonroad diesel engine and equipment market is an international market. This point has been made both by EPA and by many of the engine and equipment manufacturers who commented on the proposal. Nonroad diesel and engine manufacturers sell their products around the globe. As such, even today engine and equipment manufacturers sell products into markets which have emission requirements for nonroad engines (such as the U.S., Europe, and Japan) as well as countries which do not have emission standards. We have spoken with a number of engine manufacturers who today produce a combination of nonroad diesel engines which meet no emission standards, Tier 1 standards, and Tier 2 standards for the same basic engine platform. For some of the highway heavy-duty engine manufacturers, in addition to producing Tier 0, Tier 1, and Tier 2 nonroad diesel engines, they also produce on the same production line engines which comply with the 1998 and the 2004 U.S. highway heavy-duty emission standards. Based on current practices, and the fact that the nonroad diesel market is a global market, we expect many engine companies to continue to sell Tier 3 types of engines in the Tier 4 time-frame.

Finally, we expect that those engine manufacturers which do not intend to continue to sell engines outside of markets which have Tier 4 or Tier 4-like emission standards would be able to remove the PM and NOx aftertreatment hardware from their Tier 4 certified engines and, with minimal effort, be able demonstrate compliance with the Tier 3 standards in order to supply equipment customers with engines under the flexibility program.

9.2.2 Percent of Production Allowance

9.2.2.1 Commenter Generally Supports the Percent of Production Provisions

What Commenters Said:

EMA commented that it generally supports the proposed provisions regarding the Percent-of-Production allowance, but did not provides any additional discussion.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 111

Our Response:

We agree with the commenter and are retaining the percent of production allowance under the Tier 4 flexibility program. We also are allowing for the potential expansion of this allowance on a case-by-case basis under the technical hardship allowance adopted in this final rule, as explained in the following response and elsewhere in the administrative record.

9.2.2.2 EPA Should Expand the Percent of Production Allowances

What Commenters Said:

Ingersoll-Rand commented that if EPA does not establish 18 months of lead-time after an engine "made available" date as recommended by Ingersoll-Rand *[see additional discussion on lead-time under Issue 9.2.1.2.]*, modifications should be made to the percent of production allowances. Ingersoll-Rand believes that EPA should increase the level of flexibility to make it proportionate to the difficulty of the proposed rule. Specifically, the commenter stated that EPA should expand the percent of production allowances from 80 percent to 150 percent. In discussions with Ingersoll-Rand, the company revised their request to apply the expanded percent of production allowances to non-integrated equipment only (i.e., equipment in which the equipment is not also made by the manufacturer of the engine). By written communication, the company also indicated that no increase in the percent of production allowance was needed for the less than 25 horsepower category, and that an increase to 120 percent (rather than 150 percent) would be appropriate for the 25 to 75 horsepower category. In addition, the use of the percent of production allowances should be based on total production volume of all machines, rather than limiting the use of allowances to equipment within EPA's selected power categories.

Letters:
Ingersoll-Rand, OAR-2003-0012-0504 p. 16
Ingersoll-Rand, OAR-2003-0936, p. 2
Ingersoll-Rand, OAR-2003-0937, p. 2

Our Response:

Although we disagree with Ingersoll Rand’s comments that expanded flexibility will be needed across the board by all non-integrated equipment manufacturers, we agree that there could be circumstances of extreme technical or engineering difficulties which justify additional exemption through an increase in the percent of production allowance. We have adopted such a provision in the final rule. It is modeled after the hardship provision in existing regulations in that it requires a showing of technical or engineering difficulty which is extreme and unexpected, and against the occurrence of which the equipment manufacturer exercised reasonable precaution. However, unlike the existing economic hardship flexibility, there is no requirement to demonstrate extreme economic harm (and information regarding cost would be irrelevant to an application under the technical hardship provision). Rather, we are requiring that the equipment manufacturer applicant provide information documenting that an extreme and unavoidable technical/engineering challenge has arisen. To evaluate an application, the rule requires that the applicant supply information relating to the design process for the equipment in question. The information would have to address the normal business relationship between the equipment manufacturer and engine supplier, the extreme technical or engineering problems that have arisen and why they are not immediately solvable, information or products received from the engine supplier (i.e. drawings, specifications, prototype engines) and when received, why the design process has worked for other equipment but not for the item in question, and the equipment manufacturer’s efforts to find other compliant engines. These information submittal requirements are drawn in part from Ingersoll’s comments, where they mentioned this type of information as needed for equipment manufacturers to successfully design equipment for compliant engines, and also from EPA’s own study of and discussions with equipment manufacturing industry members. EPA also would reserve the right to request other relevant information, and also to cross-check any information received in the application with other entities (notably engine suppliers) to verify its accuracy.

If an application is granted, EPA could expand the existing percent of production allowance from 80 percent per power category by as much as an additional 70 percent (so that there could be a maximum 150 percent of production allowance per power category). This program would only apply to the power categories between 25 and 750 horsepower. However, to justify granting additional lead time in the form of expanded percent of production, we would require that the applicant demonstrate there is a reasonable likelihood it will utilize the existing 80 percent provided under the percent of production allowance for the power category in the first two years of the seven year flexibility period (since if that allowance has not been used, there is no need for additional lead time). We would also require that this technical/engineering hardship allowance expire 24 months after the start of the seven year flexibility period. This is because we believe that any technical or engineering problems should be solvable in the first 24 months after the Tier 4 standards take effect. Ingersoll-Rand has in fact notified EPA, by letter, that this technical hardship case-by-case flexibility provision satisfies all of its concerns regarding adequacy of equipment manufacturer lead time to meet the Tier 4 standards.

In response to the comment that allowances should be based on total production volume of all machines, rather than limiting the use of allowances to equipment within EPA's selected power categories, we disagree that such an approach is appropriate. The flexibility allowances are based on the view that the introduction of the Tier 4 standards in each power category could trigger the need for implementation flexibility for the equipment manufacturers using those engines and that the need for the flexibilities is generally the same in all power categories. Expanding the exemption by letting a manufacturer increase its exemptions in one power category where they have small sales because they have large sales in another power category would run contrary to this approach, and could create significant competitive inequities between companies, and provide more lead time than necessary, contrary to the command of section 213(b). Therefore, we are not adopting provisions that would allow equipment manufacturers to calculate the amount of allowance provided under the flexibilities based on total sales across all power categories. Instead, as proposed, the final program provides allowances in each Tier 4 power category based on a manufacturer's total sales in that power category.

9.2.3 Small-Volume Allowance

9.2.3.1 Commenters Support EPA's Proposed Small-volume Allowance Program, but Offer Suggestions for Improvement

What Commenters Said:

A number of commenters stated that EPA should implement the proposed small-volume allowance program that allows up to 700 units to be exempted over seven years, however, the program should be implemented without the single engine family restriction. Even though eliminating the single family restriction would allow for more exemptions within a power category, there are significantly fewer power categories under the Tier 4 rule than under the Tier 2/3 (a reduction from 9 categories to 5). Therefore, EPA's concerns regarding a proliferation of exemptions have been addressed. One commenter (ARTBA) noted that the maximum number of 700 exemptions should be retained.

Letters:
American Road and Transportation Builders Association, OAR-2003-0012-0633 p. 2
Association of Equipment Manufacturers, OAR-2003-0012-0669, 0670 p. 8-9
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 5
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 30, 111
Ingersoll-Rand, OAR-2003-0012-0504 p. 17

EMA offered the suggestion that if EPA does not implement the small-volume allowance program without the single family restriction, then the program should provide manufacturers with an option to choose either the proposed or the alternative program. The commenter believes that this approach would preserve a competitive balance.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 30, 111

CNH Global commented that it supports the proposed variation to the small-volume allowance since it would balance the allowance with total engine production by power category. This is very important for individual product lines as the current program allows a small-volume manufacturer to capture a significant market share with lower cost and higher emitting engines than for a manufacturer that must use percent-of-production allowance.

Letters:
CNH Global, OAR-2003-0012-0819 p. 8

Our Response:

With the Tier 4 final program we are adopting both the proposed small volume allowance (which allows a manufacturer to exempt up to 700 units over 7 years in any power category, with a maximum of 200 in any given year, provided the engines are limited to one engine family in each power category) as well as the alternative small volume allowance discussed in the proposal (which allows manufacturers to exempt fewer engines over 7 years, but without the one engine family restriction noted for the other option). Equipment manufacturers wishing to use the small volume allowance will be able to choose between the two options.

We are not eliminating the one engine family restriction from the 700 unit small volume allowance option as suggested by commenters because it would result in a significant increase in the number of engines eligible to be exempted to levels which we believe are not needed to provide adequate lead time for the Tier 4 program. Based on sales information for small businesses, we estimated that the alternative small-volume allowance program (which includes the lower caps and allows manufacturers to exempt more than one engine family) would keep the total number of engines eligible for the allowance at roughly the same overall level as the current 700-unit program. Giving equipment manufacturers the ability to choose between the two small volume allowance options is not expected to significantly impact the number of engines likely to be exempted under the small-volume allowance.

9.2.3.2 Commenter Recommends That EPA Establish Safeguards to Prevent Inappropriate Use of Small Volume Allowances by Separate Legal Entities That Are under the Same Ownership

What Commenters Said:

EMA commented that EPA should establish safeguards to prevent inappropriate use of small volume allowances by separate legal entities that are under the same ownership, but provided no additional discussion or information.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 31

Our Response:

We believe our regulations have safeguards to prevent inappropriate use of the small volume allowances by separate legal entities. As under the existing program, all entities under the control of a common entity, and that meet the regulatory definition of a nonroad vehicle or nonroad equipment manufacturer, must be considered together for the purpose of applying exemption allowances. The regulations specifically require an equipment manufacturer to include equipment from any parent or subsidiary companies and equipment from any other companies which they licence to produce equipment for them. The requirement to include all of these entities in the count will not only provide certain benefits for the purpose of pooling exemptions, but will also preclude the abuse of the small-volume allowances that would exist if companies could treat each operating unit as a separate equipment manufacturer.

9.2.3.3 Proposed Small Volume Allowance Regulatory Language Should Be Revised to Be Consistent with the Percent of Production Regulatory Language

What Commenters Said:

DDC and EMA commented that the proposed regulatory language describing the small volume allowance places the exemption limit on the number of equipment units produced within the power category. To be consistent with the percent of production allowance, the limit should apply not to the total number of units produced, but to the number of U.S.-directed units produced.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 5
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 30

Our Response:

We agree with the commenters that the limit on the number of engines produced under the small volume allowance should only apply to U.S.-directed units. Section 1039.625(b)(2) of the regulations has been revised accordingly.

9.2.4 Hardship Relief Provision

9.2.4.1 Commenter Supports the Hardship Relief Provision

What Commenters Said:

EMA commented that it generally supports the hardship relief provision, but provided no additional discussion or supporting documentation.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 30, 111

Our Response:

We agree with the comment and are retaining the hardship relief provisions as proposed in the Tier 4 final program. (In addition, we are adopting a technical hardship flexibility provision, discussed in earlier responses, in response to comments.)

9.2.4.2 EPA Should Allow for Hardship Relief When Events That Are Beyond the Control of the Equipment Manufacturer Prevent the Timely Introduction of Tier 4 Machines, and Should Not Necessarily Require a Showing of Undue Economic Hardship

What Commenters Said:

Ingersoll-Rand commented that in order to obtain hardship relief from EPA, an equipment manufacturer must submit an application before the earliest date of potential noncompliance. The eligibility for hardship relief should not require a demonstration of severe economic hardship, a term which is not defined in the regulation but connotes a high threshold of economic harm. EPA should make hardship relief available if any engine manufacturer currently supplying engines to an equipment manufacturer fails to provide a new certifiable prototype engine with written specifications and performance data at least 18 months prior to the applicable Tier 4 compliance date.

Letters:
Ingersoll-Rand, OAR-2003-0012-0504 p. 17-18
New York Public Hearing, A-2001-28, IV-D-05 [IR p. 227]

Our Response:

As described earlier in "Our Response" to issue 9.2.1.2.,we disagree with Ingersoll Rand's premise that Tier 4 will create a situation where expanded equipment maker lead time is the norm rather than the exception so that the rule must provide a drastic expansion of equipment manufacturer lead time. However, we agree with the commenter that there may be circumstances where additional lead time is needed for equipment manufacturers due to extreme technical or engineering circumstances that the equipment manufacturer could not control and took reasonable precautions to prevent. We further agree that, if these circumstances arise, it is appropriate, as an element of providing sufficient lead time, for there to be further flexibility to use noncompliant engines without having to make a showing of extreme economic hardship. We have consequently adopted an additional flexibility for technical or engineering hardship in the final rule. Details are provided in section III.B.2.b of the preamble, and in other comment responses in this document.

9.2.4.3 The Hardship Provisions Should Be Extremely Limited

What Commenters Said:

The Clean Air Council commented that economic hardship proposal is hard to justify. If a manufacturer or refiner is unable to meet standards that all its counterparts are subject to, then perhaps it should not play a role in the industry. If EPA includes a hardship provision, it should be limited to a year or less of compliance flexibility.

Letters:
Clean Air Council, OAR-2003-0012-0613 p. 2

Our Response:

We continue to believe that there may be circumstances in which hardship relief is appropriate under the Tier 4 program. Given the criterial that an equipment manufacturer must demonstrate before being considered for hardship relief, we expect that the hardship relief provisions will be rarely used. This expectation has been supported by our initial experience with the Tier 2 standards in which only one equipment manufacturer has applied under the hardship relief provisions (and the request was subsequently denied). Therefore, we are retaining the hardship relief in the final Tier 4 program.

9.2.5 Existing Inventory Allowance

9.2.5.1 Commenter Supports the Provisions That Allow Manufacturers to Use Existing Inventories of Older Engines and Permit the Sale of Replacement Engines

What Commenters Said:

EMA commented that these are necessary provisions to account for the routine and unavoidable lag between engine build and machine assembly, and are a normal consequence of transitioning to a new set of standards.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 30-31, 111

Our Response:

We agree with the comments and are adopting the existing inventory allowance as proposed.

9.2.6 Notification, Reporting, and Labeling Requirements

9.2.6.1 Commenter Supports the Notification and Reporting Requirements in the Context of the Tier 4 Transition Provisions

What Commenters Said:

EMA commented that it supports the proposed notification and reporting requirements. The commenter further noted that, proposed under the transition provisions, equipment manufacturers and importers should provide EPA with estimates of the number of non-Tier 4 engines to be used in each power category and annual reports detailing the number of exempt engines bought and sold under the flexibility provisions.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 31

Our Response:

We agree with the comments and are adopting the notification and reporting requirements as proposed.

9.2.6.2 EPA Should Eliminate the Labeling Requirements for Equipment Affected by the Transition Program for equipment Manufacturers (TPEM)

What Commenters Said:

DDC and EMA commented that EPA should not impose a requirement to label equipment that contain engines built under the Transition Program for Equipment Manufacturers (TPEM). Under the Tier 1 and 2 rules, TPEM engines already are installed in nonroad equipment, yet there is no additional labeling required by equipment manufacturers. There is nothing in the proposed Tier 4 rule that would necessitate a different approach. Requiring equipment manufacturers to label already-labeled engines is burdensome, costly, and unnecessary. If EPA can justify a TPEM labeling requirement for equipment manufacturers, then the requirement should be applicable only to Tier 4 engines and should not be applied retroactively to Tier 3 or earlier transitional engines. DDC and EMA also commented that EPA should allow manufacturers to include any other additional information on the label.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 7
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 82-83

Our Response:

We believe these new labeling requirements will allow EPA to easily identify the exempted equipment, verify which equipment manufacturers are using these exceptions, and more easily monitor compliance with the transition provisions. Labeling of the equipment should also help U.S. Customs to quickly identify equipment being imported using the exemptions for equipment manufacturers. For these reasons, we are adopting the labeling requirement for engines sold under the Tier 4 flexibility program.

With regard to the comment on whether these labeling requirements should also apply to the current Tier 2/Tier 3 transition program, we are not adopting new labeling requirements for equipment manufacturers for the current Tier 2/3 program. Although we requested comment on this issue, we do not believe it is appropriate to make changes to the existing Tier 2/3 flexibility program since this rule covers compliance with newly adopted Tier 4 program only.

With regard to the comment on including other information on the equipment label, the labeling requirements finalized in 40 CFR Part 1039 allow manufacturers to include additional information on the label provided they have received prior approval from EPA.

9.2.6.3 EPA Should Revise the Labeling Requirements for Engines Affected by the Transition Program for Equipment Manufacturers (TPEM)

What Commenters Said:

DDC and EMA commented that EPA's proposed requirement for the labeling of transitional engines is unclear and could lead to significant confusion. The Section 1039.135 label states that the engine conforms to the current model year standards, so adding a label that states that the engine is exempt from the current standards will only confuse customers. Engines produced under the TPEM program are not certified to the current standards and as a result, the certification compliance statement required by Section 1039.135 cannot be made without putting manufacturers at significant risk. Also, it will not be possible to label a transitional engine with an engine family name since TPEM engines are not part of a currently-certified family. The commenters also suggested that EPA should require a TPEM label that only includes the heading "Emission Control Information," the corporate name and trademark of the manufacturer, and the statement recommended in Section 1039.625(j); and this provision should only apply to Tier 4 engines and not to Tier 3 or earlier transitional engines.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 7
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 83-84

Our Response:

We agree with the comments that the proposed requirements for labels placed on flexibility engines could lead to confusion and problems because the flexibility engines are not certified to the Tier 4 standards which normally would apply in the absence of the flexibility provisions. In response to these comments, we have revised the labeling requirements for flexibility engines. Under Section 1039.135 of the final Tier 4 regulations, the label on the flexibility engines will no longer need to include a statement that the engine conforms to the current model year standards or a reference to an engine family name.

With regard to the comment on whether these labeling requirements should also apply to the current Tier 2/Tier 3 transition program, we are not adopting new labeling requirements for equipment manufacturers for the current Tier 2/3 program. Although we requested comment on this issue, we do not believe it is appropriate to make changes to the existing Tier 2/3 flexibility program since this rule covers compliance with newly adopted Tier 4 program only.

9.2.6.4 EPA Should Eliminate the Notification Requirement for Equipment Manufacturers Who Plan to Use the Transition Provisions since it Creates an Unnecessary Burden and Provides Minimal Benefit

What Commenters Said:

Ingersoll-Rand commented that if EPA must retain the notification requirement, EPA should clarify that such projections are non-binding, good faith estimates of production volumes that can be adjusted up or down to meet market conditions. The commenter also stated that EPA should include a specific provision that acknowledges that data submitted with a notification of intent to use the transition provisions qualifies as confidential business information.

Letters:

Ingersoll-Rand, OAR-2003-0012-0504 p. 19

Our Response:

We disagree with the commenter that the notification requirement is unnecessary and continue to believe the new notification requirements will greatly enhance our ability to ensure compliance with the flexibility provisions. Given the limited information that must be provided by equipment manufacturers, we do not expect that the notifications will require any significant effort to pull the information together and submit to EPA. With regard to comment on confidentiality, a manufacturer can always request that some or all of the information supplied in the notification be treated as confidential business information as provided in 40 CFR Part 2, Subpart B. If such a claim is made, the information covered by the confidentiality claim will be disclosed by the Administrator only to the extent allowed under the provisions of 40 CFR Part 2, Subpart B.

9.2.7 Foreign Manufacturers and Importers

9.2.7.1 Commenter Supports the Flexibility Provisions for Equipment Produced by Foreign Manufacturers

What Commenters Said:

EMA commented that it supports the flexibility provisions for equipment produced by foreign manufacturers, since foreign manufacturers that comply with the Tier 4 compliance provisions would be able to use the same transition flexibilities as domestic manufacturers, while importers that have little involvement with the manufacturing and assembling process would not. EPA should ensure that foreign manufacturers are required to comply with the same regulatory provisions as domestic manufacturers.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 31, 111

Our Response:

We agree with the comments and are adopting requirements that would apply specifically to foreign equipment manufacturers and equipment importers.

We have made one change to the bonding requirements that apply to foreign equipment manufacturers choosing to participate in the Tier 4 flexibility program. We have eliminated the option to pay the bond amount directly to the U.S. Treasury. Based on experience with the bonding requirements for foreign gasoline refiners, no regulated entity has chosen to pay the bond directly to the U.S. Treasury. They have opted to obtain a bond through a third-party surety agent. We believe it will be the same situation for this program and therefore we are dropping the option to pay the bond directly to the U.S. Treasury. We do not believe an equipment manufacturer would choose to pay the full bond amount to the U.S. Treasure for a period of up to 12 years (the seven-year flexibility period plus an additional five years during which we could still consider enforcement violations), but would opt to obtain a bond at lower cost through a third-party surety agent. Therefore, dropping the option should not impact the ability of foreign equipment manufacturers to comply with the bonding requirements if they choose to participate in the

Tier 4 flexibility program.

9.2.7.2 Flexibility Provisions for Foreign Equipment Manufacturers Should Not Apply to U.S. Based Companies with Offshore Manufacturing Facilities

What Commenters Said:

Ingersoll-Rand commented EPA should clarify that the flexibility provisions for foreign equipment manufacturers should not apply to U.S. based equipment manufacturering companies with offshore manufacturing facilities (as defined in 40 CFR 1039.801), including its affiliated companies and divisions, when the manufacturer is headquartered or incorporated in the U.S.

Letters:
Ingersoll-Rand, OAR-2003-0012-0504 p. 19

Our Response:

The purpose of the provisions for foreign equipment manufacturers is to ensure that all equipment manufacturers are subject to enforcement under our regulations, regardless of where the company is headquartered or where the equipment is manufactured. While we recognize that a company that is headquartered or incorporated in the U.S. would be easier to enforce against in the case of noncompliance with the flexibility provisions, we believe it is important that all companies importing equipment to the U.S. comply with the requirements for foreign equipment manufacturers. Neither the notification requirements described earlier for foreign equipment manufacturers nor the bonding requirements should cause any burden for companies with significant presence in this country. We would expect that only those companies with limited presence or no presence in this country will be impacted to any measurable degree because of the requirements placed on foreign equipment manufacturers. Therefore, for the Tier 4 program, all manufacturers that produce equipment outside of the United States that is eventually sold in the United States will have to comply with all requirements for foreign equipment manufacturers.

9.2.7.3 Flexibility Provisions Provide an Advantage to US. Manufacturers

What Commenters Said:

CEMA/CECE commented that EPA's flexibility provisions appear to provide an advantage to U.S. manufacturers. The commenter did not provide additional discussion on this issue or details on the flexibility provisions to which they are referring.

Letters:
CEMA/CECE, OAR-2003-0012-0598 p. 4

Our Response:

The flexibility provisions adopted for the Tier 4 program (i.e., the percent of production allowance, the small volume allowance, and the hardship relief provisions) are available to all manufacturers whether they are U.S. manufacturers or foreign manufacturers, so we do not believe that these provisions provide an advantage to U.S. manufacturers. With regard to the other requirements that apply under the Tier 4 flexibility program, we have adopted special provisions that apply to foreign equipment manufacturers. While these requirements may place additional requirements on some manufacturers, we believe they are necessary to ensure that all equipment manufacturers are subject to enforcement under our regulations, regardless of where the company is headquartered or where the equipment is manufactured. In addition, they will ensure that we have the ability to recover monetary penalties from a manufacturer determined to be in violation of the program requirements which may not be possible without the additional requirements for foreign manufacturers.

9.3 Small Business Provisions

9.3.1 General

What Commenters Said:

The Clean Air Council commented that any additional lead time granted to small manufacturers should be extremely limited- EPA should only provide at most a single year of additional time for small manufacturers.

SBA Office of Advocacy commented that EPA's small business flexibilities for small engine and equipment manufacturers, as well as small refiners, are insufficient on their own to appropriately minimize the regulatory burdens on small entities. During the statutory SBAR Panel, Small Entity Representatives informed EPA, Advocacy, and OIRA that the flexibilities EPA considered there and subsequently included in the proposed rule, would not result in reduced regulatory burden. Equipment manufacturers noted that even if the regulations allow for some noncompliant equipment to be sold, they would not produce or sell such equipment. Even though EPA has allowed for delayed compliance, the manufacturers will ultimately need to comply. EPA has not shown that a substantial number of small businesses have taken advantage of previous small business flexibilities or that they would take advantage of, or benefit from, the flexibilities in the proposed rule.

<u>Letters:</u>
Clean Air Council, OAR-2003-0012-0613 p. 2
U.S. Small Business Administration Office of Advocacy, OAR-2003-0012-0815 - 0818 p. 11-12

Our Response:

We do not agree with the statement that lead time for small manufacturers should be ‘extremely limited.’ While we do agree that small entities will ultimately need to comply with the standards, these entities have an inherent degree of hardship in that they generally do not have the personnel, financial, or engineering resources that larger manufacturers do, and so may need additional lead time. Thus, they will face a significant burden in complying with new standards absent some regulatory flexibility. For some applications/horsepower categories, this may mean a year of lead time; however, for other categories, more may be necessary to provide adequate and appropriate lead time.

In regard to the comments from Advocacy, some small business equipment manufacturers informed us that they had not taken advantage of the current small business flexibilities due to the fact that the provisions were difficult to understand (although we did not receive any comments from small business equipment manufacturers during the public comment period stating that the proposed provisions would not be helpful) and some manufacturers found that they were still able to comply without the use of the provisions. To address these comments, we are finalizing additional transition provisions- the alternative small volume option- which we believe will provide more flexibility to small businesses in complying with the new standards, and provide appropriate lead time where needed, and these options were developed using sales information from small businesses. We also will be issuing a Small Entity Compliance Guide which will help to explain the flexibility provisions. The guide will be available within 60 days of the effective publication date of this rulemaking, and will be available on the Office of Transportation and Air Quality website.

During the SBREFA process, some small business equipment manufacturers informed us that the regulations would provide an additional burden due to the fact that the company also sells equipment to other countries which will not require more stringent standards. These manufacturers were concerned that these customers would not want to purchase new Tier 4 compliant equipment. As explained in section III.B.2.g, under the existing inventory allowance available to all equipment manufacturers, equipment manufacturers are allowed to continue to use engines built before the effective date of new standards. Thus, small business equipment manufacturers can continue to use their current engine/equipment configuration, within limits, and avoid out-of-cycle equipment redesign until the allowances are exhausted or the time limit passes. Further, as discussed above in 9.2.1.10, based on the experience with the current Tier 2/3 program, we believe that engine manufacturers will produce such engines.

Advocacy's assertions notwithstanding, small business engine manufacturers did not provide any comments during the SBREFA process, nor during the public comment period, stating that the transition provisions were insufficient. In fact, we received comments from one small engine manufacturer (see comment in 9.3.2.1, below) stating that these provisions are both necessary and sufficient for compliance with today's standards. Similarly, we received comments from small refiners during both the SBREFA process and the public comment period that the proposed provisions were sufficient and would be beneficial to small refiners. Expanding these allowances, as Advocacy urges, would thus simply be providing more lead time than necessary, contrary to the lead time forcing section 213 (b).

More information on the provisions that are being finalized for small entities can be found in sections III.C (provisions for small business engine and equipment manufacturers) and IV.B (provisions for small refiners, terminal operators, etc.), as well as section X.C of the preamble to today's rule.

9.3.2 Small Engine Manufacturers

9.3.2.1 Supports the Proposed Provisions for Small Engine Manufacturers

What Commenters Said:

Lister Petter commented that it supports the proposed provisions for small business engine manufacturers. Small manufacturers do not receive the same attention from potential suppliers of the critical technologies for Tier 4 emissions control and fuel injection systems. Lister Petter notes that to date, they have not been able to attract a manufacturer to work with them in a co-development mode, which precludes their ability to complete effective development work on the necessary technologies as early as the larger engine manufacturers. This commenter adds that the three-year delay is consistent with their estimates and experience regarding how long it may take for the necessary technologies to be available to them. Lister Petter also commented that smaller [engine] companies will be dependent on the technologies and product systems developed by the aftertreatment and fuel injection system manufacturers. In addition, these companies may be particularly vulnerable in the event that a supply monopoly develops in the aftertreatment market.

Letters:
Lister Petter, OAR-2003-0012-0155 p. 2

Our Response:

We agree with the commenter, and therefore we are finalizing the transition (and hardship) provisions that we proposed for small business engine manufacturers. While we believe that emissions from nonroad engines have a significant effect on emissions, we believe that offering transition provisions to small business engine manufacturers will have a negligible effect on air quality and the emissions inventory; and these provisions will provide needed lead time for these manufacturers.

9.3.3 Small Business Equipment Manufacturers

What Commenters Said:

The SBA Office of Advocacy commented during the interagency review process that EPA should not adopt an aftertreatment-based standard for PM for 25-50 hp engines.

Our Response:

Please see the response to issue 3.1.4.4 for a complete discussion of this issue.

9.4 Encouraging Innovative Technologies

9.4.1 Credit for Early or Very Low Emission Engines

9.4.1.1 EPA Should Adopt the Early Incentives Program

What Commenters Said:

Environmental Defense, MECA, and STAPPA/ALAPCO commented that EPA should ensure that any early reduction credits are fully enforceable and verifiable. STAPPA/ALAPCO also added that EPA should ensure that any early engine credits earned for a diesel-fueled engine are predicated on the assurance by the manufacturer that the engine would be fueled with less than 15 ppm sulfur fuel. EPA should be rigorous in designing a sensible program since it will address a variety of different engines functioning in divergent operating conditions.

Letters:
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 11
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 19
Environmental Defense, OAR-2003-0012-0821 p. 18

STAPPA/ALAPCO also commented that as an additional incentive to introduce clean engines and vehicles early, EPA is proposing a provision that would give manufacturers an early introduction credit equal to two engines during or after the phase-in years. Due to the extremely low emission levels to which these Blue Sky series engines and vehicles would need to certify, the double engine count as a basis for this early introduction credit is appropriate.

Letters:
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 19-20

SCAQMD commented that EPA should examine incentive program options for manufacturers who voluntarily introduce the new engines sooner, exceed the required standards, or accelerate the engine replacement in any "extreme" or "severe" nonattainment areas such as the South Coast Air Basin. In order to encourage development and commercialization of new and more advanced control technologies for nonroad engines, SCAQMD commented that EPA should also establish optional standards in its proposed rulemaking based on compliance with voluntary and more stringent standards. These standards would facilitate emission credit generation opportunities and generate surplus emission reductions.

Letters:
South Coast Air Quality Management District, OAR-2003-0012-0623 p. 7

9.4.1.2 EPA Should Not Adopt the Early Incentive Program

What Commenters Said:

EMA commented that EPA's proposal to allow manufacturers to be able to have one "early" engine offset of 1.5 or 2.0 Tier 4 engines should be eliminated. The motivation behind this complex provision and the method in which it is intended to be used is unclear. An incentive to encourage manufacturers to introduce low emission technology early is already provided through the ABT program.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 39

Our Response (to 9.4.1.1-9.4.1.2):

We continue to believe that there is a significant environmental benefit from early introduction of engines complying early with Tier 4 aftertreatment-based standards, both in the form of earlier emission reductions, and in the value of early introduction of the technology, which facilitates development and use of the aftertreatment in other nonroad applications. Like the ABT program, EPA has structured this incentive program so that credits are verifiable and enforceable.

We are finalizing the incentive program, although we are modifying it by allowing equipment manufacturers to be eligible and to have a right of first refusal to any offsets which are generated. We believe that the program properly ensures that the early emission reductions occur, without creating unmanageable burdens for manufacturers. We agree with EMA that the ABT program already provides some incentive, but, as explained above, there are important benefits in the early introduction of aftertreatment technology, and we feel some additional incentive is justified to encourage such early introduction.

9.4.2 Extending the Existing Blue Sky Program

9.4.2.1 EPA Should Extend the Existing Blue Sky Program

What Commenters Said:

MECA expressed support for extending the Blue Sky Program, but provided no additional discussion or supporting documentation.

Letters:
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 11

9.4.2.2 EPA Should Not Extend the Existing Blue Sky Program

What Commenters Said:

Environmental Defense and STAPPA/ALAPCO commented that the levels set for the existing Blue Sky program are not stringent enough to warrant their continuance into the Tier 4 years. The incentives focus should shift to advanced technologies and the existing Blue Skies program contributes little to this and should be terminated once the Tier 4 standards are introduced. Environmental Defense added that a revised Blue Sky Series engine program that would achieve reductions below Tier 4 levels could be appropriate.

Letters:
Environmental Defense, OAR-2003-0012-0821 p. 18
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 19-20

Our Response (for 9.4.2.1 - 9.4.2.2):

Given the very low emission levels being adopted in Tier 4, we believe that the Blue Sky Series program in 40 CFR Part 89, which does not encourage engines emitting at such low emission levels, should not be extended. We also note that section 1039.104 (a) for early introduction of engines certified to Tier 4 or more stringent levels creates the incentives some of the commenters desired.

9.4.3 EPA Should Establish More Stringent Optional Standards to Facilitate Credit Generation

What Commenters Said:

SCAQMD commented that in order to encourage development and commercialization of new and more advanced control technologies for nonroad engines, EPA should also establish optional standards in its proposed rulemaking based on compliance with voluntary and more stringent standards. These standards would facilitate emission credit generation opportunities and generate surplus emission reductions.

Letters:
South Coast Air Quality Management District, OAR-2003-0012-0623 p. 7

Our Response:

We believe that the ABT provisions and early incentive programs will be sufficient for the purpose of encouraging the early use of the advanced emission controls.

9.5 Test Procedures

9.5.1 Transient Test

9.5.1.1 Supports Transient Testing

What Commenters Said:

A number of commenters stated that they support transient testing, and noted that the proposed transient emissions test is necessary to ensure that the targeted emission reductions are achieved in use. NESCAUM noted that test data, including data from a NESCAUM nonroad emissions testing and pilot retrofit project at Salem Harbor and at EPA's Ann Arbor lab in 1998, demonstrate the need for a transient test cycle for nonroad diesel engines. And added that the NESCAUM results showed that PM emissions on a steady-state cycle are as much as 30 percent lower than PM emissions on a more representative, transient cycle and that without the development of a transient test cycle, nonroad diesel emissions could be substantially under-estimated. The commenters recommended, however, that testing on the NRTC cycle for engines under 75 hp be required prior to the proposed date of 2013, with some commenters (CATF, STAPPA/ALAPCO) specifically recommending a deadline of 2008 (or as soon as Tier 4 requirements are introduced for a given engine category). STAPPA/ALAPCO added that the overriding principle should be how well the test reflects actual vehicle or engine operation and that five years is more than adequate time to purchase engines and become knowledgeable regarding transient tests.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 10
Clean Air Task Force, et. al., OAR-2003-0012-0508 p. 21-22
NESCAUM, OAR-2003-0012-0659 p. 7
Pennsylvania Department of Environmental Protection, OAR-2003-0012-0699 p. 4
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 13
Union of Concerned Scientists, OAR-2003-0012-0830 p. 8
New York Public Hearing, A-2001-28, IV-D-05 [CARB p. 144; NESCAUM p. 99]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [CARB p. 19]

The New York Department of Environmental Conservation commented that for any regulation to be truly strong it must follow stringent test procedures and enforcement policies designed to ensure compliance and applicability. While NTE partially meets these standards, certification testing procedures must emulate in-use operation and use fuels that are representative of in-use fuels. To that end, transient testing is as necessary as steady testing for all but a very small number of applications.

Letters:
New York Public Hearing, A-2001-28, IV-D-05 [NY DEC p. 13]

NRDC commented that by capturing more transient emissions over much of the typical nonroad engine operating range, the NRTC will help ensure effective control of all regulated pollutants.

Letters:
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 28-29

Our Response:

The Agency shares the concerns expressed for the inability of steady-state testing alone to adequately capture the full range of emissions which a particular piece of nonroad equipment might experience in-use. EPA further agrees that transient testing is necessary in this mobile source segment to ensure a high degree of control of in-use engine emissions. However, we do note that the concerns we voiced in earlier rules regarding the need for a transient cycle to assure control of PM emissions are less significant for the aftertreatment-based PM standards[45]. This is because, as explained in chapter 4.1.2 of the RIA, the PM traps on which the standard is predicated will function equally effectively across all engine operating features in controlling the soot and SOF portion of PM emissions (assuming proper regeneration, of course). The interim 2008 standards for PM, however, are not predicated on use of aftertreatment, and some commenters urged that EPA accelerate the timetable for applying the transient test so it applies from the inception of these standards. Although an intriguing possibility (see section III.F of the preamble to the final rule), EPA believes that it is better not to divert finite resources into accelerated transient testing of smaller engines, but rather direct those resources primarily at complying with the aftertreatment-based standards (which will result in the bulk of the environmental benefits from the nonroad standards). Id. We consequently are not requiring transient testing for 25-75 hp engines until they are required to meet an aftertreatment-based PM standard, and not requiring under 25 hp engines to certify using transient testing until 2013. Additionally, given the control strategies expected to be utilized for NOx control, the transient test will help to ensure that the appropriate control algorithm constraints are applied.

9.5.1.2 Conditionally Supports the Transient Testing Requirements

What Commenters Said:

EMA commented that the proposed implementation schedule for a transient cycle for engines <

[45] The NESCAUM comment referring to 30 % difference in PM emissions from nonroad engines when measured under steady state and transient conditions did not involve engines using PM traps for PM control.

560 kW is appropriate provided EPA sets definitive interim Tier 4 average standards. However, if EPA elects to proceed with the phase-out/phase-in approach for NOx, the transient cycle should only be applicable to testing for PM emissions and not NO_x, HC and CO for phase-out engine families since the application of the transient test cycle and standards could result in the need to redevelop the NO_x/HC/CO emission control systems used for Tier 3 compliance. The NRTC should not apply to any power category until 2011 at the earliest.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 55

Euromot commented that the NRTC is not yet sufficiently adapted to be used on hydraulic dynamometers. EPA should allow for any potential amendments to the NRTC resulting from the GRPE "Nonroad Motor Machinery (NRMM)" subgroup activities in this respect. Euromot also stated that EPA's estimate of the cold start portion of engines used in nonroad applications at 4 percent is too high. Given such low numbers, the resulting burden for testing is unreasonably high in terms of cost and test equipment capacity. The commenter believes that EPA should eliminate this requirement.

Letters:
Euromot, OAR-2003-0012-0822, 0823 p. 10

Our Response:

EPA is adopting the proposed phase-in/phase-out approach for NOx (as one compliance alternative). We are addressing the applicability of the NRTC during the phase-in/phase-out period as follows. Under the final regulations, only engines that met all of the new requirements, including transient testing, NTE, and the lower Tier 4 FEL caps will qualify as phase-in engines. Manufacturers producing these phase-in engines can produce a corresponding number of phase-out engines. These engines can be certified in one of two ways, with respect to their gaseous pollutant emissions. If the engine is certified to the identical level and FEL as it was certified to under the Tier 3 requirements, then the engine will not be required to certify with the transient test (or NTE), the reason being that it is still essentially a Tier 3 engine with respect to gaseous pollutants. If the engines are certified to a changed level for gaseous emissions, the engines will be required to certify using the transient (and NTE) tests. Transient testing (and NTE testing) would always be required for certification with the PM standard for these engines, since the PM aftertreatment-based standard applies uniformly to phase-in and phase-out engines.

EPA has conducted testing for engines < 560 kW operating on an eddy current dynamometer using the NRTC. Likewise, some European engine manufacturers, notably, Deutz (see RIA Table 4.2-11), have run the same sort of test cycles. With tuning of the dynamometers, for effective transient control, acceptable emission runs have been seen using the NRTC. With upgrading of control systems and a refined strategy for fitting the hydraulic dynamometer to the NRTC, hydraulic dynamometers may be used quite usefully to run smaller to mid-size engines over this transient cycle. Significantly larger engines may require full upgrades to eddy current dynamometers, at a minimum, to successfully run the NRTC. EPA is participating in the United Nations Working Party on Pollution and Energy Nonroad Mobile Machines (GRPE NRMM) workgroup process with many of these same manufacturers who have run the NRTC in its developmental phases and we will consider the outcome of discussions held within this group in future actions, as appropriate.

9.5.1.3 EPA Should Not Delay the Application of the NRTC to Engines under 75 Hp

NRDC commented that the proposed deadlines for the introduction of the NRTC for engines above 75 hp are appropriate. However, delaying the application of the NRTC to engines under 75 hp to 2013 risks several years of unnecessarily high in-use emissions in off-cycle conditions. EPA should reconsider this proposed delay and should impose the test requirements in 2008 for these engines.

Letters:
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 29

Our Response:

Even though we are requiring that NRTC testing start when PM aftertreatment-based standards take effect, one should not infer that the NRTC is directed solely at (or even primarily at) PM control. In fact, we believe that advanced NOx emission controls may be even more sensitive to transient operation than PM filters. It is, however, our intent that the control of emissions during transient operation be an integral part of Tier 4 engine design considerations. We have therefore chosen to apply the transient test requirement starting with the PM filter-based Tier 4 PM standards as these standards precede or accompany the earliest Tier 4 NOx or NMHC standards in all power categories except engines over 750 hp.

However, we do not believe it appropriate to mandate compliance in 2008 with the transient test for the engines under 75 hp which are also subject to PM standards in 2008. We recognize that transient emission testing, though routine in highway engine programs, involves a fair amount of laboratory equipment and new expertise in the nonroad engine certification process. As with the transfer of advanced emission control technology itself, we believe that the transient test requirement should be implemented first for larger displacement engines. These engines are more likely to be made by manufacturers who provide engines to the on-highway market and therefore have had prior on-highway engine development and certification experience. We do not believe that the smaller engines should be the power categories first charged with implementing the new transient test, as early as 2008, especially because manufacturers of these engines do not generally make highway engines and are neither as experienced nor as well-equipped as their larger engine manufacturer counterparts at conducting transient cycle testing. To encourage earlier transient emission control in these engines, though, EPA will allow manufacturers of engines below 25 hp to submit data describing emission levels for their engines over the appropriate certification transient duty cycle beginning in model year 2008. We extend this option as well to manufacturers of 25-75 hp engines, subject to those engines meeting the Tier 4 transitional PM standard in 2008. Should a manufacturer choose to submit data in the 2008-2011 timeframe, prior to required certification data submissions, that transient data will not be used for compliance enforcement.

9.5.1.4 Supports Use of the Constant Speed Variable Load (CSVL) Test

What Commenters Said:

NRDC and STAPPA/ALAPCO commented that EPA should maintain the provision that allows for engine manufacturers to certify constant-speed engines using the CSVL in lieu of the NRTC. The

CSVL should be allowed as an alternative provided manufacturers that choose this approach certify that such engines would be used in constant-speed applications. The commenters offered the suggestion that EPA develop an oversight process to ensure that such engines are used only in this manner.

CARB also commented that the it supports the use of the CSVL test, but provided no additional discussion or supporting documentation.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 10
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 29
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 13

Our Response:

The Agency has decided not adopt the proposed CSVL transient duty cycle in this rulemaking (see section below for further discussion on this topic). EPA nonetheless still believes that a transient emission test cycle is appropriate for many, if not all, constant-speed nonroad engines. Instead, the Agency will work with nonroad engine manufacturers and the EMA to develop a more appropriate test cycle(s) for all constant-speed engines which is (are) more representative of the variety of constant-speed applications. EPA hopes to complete this process in time for its 2007 Technology Review.

In the event that the Agency ultimately adopts one or more constant-speed cycle for this engine segment, we will revisit engine labeling and use requirements as appropriate.

9.5.1.5 The CSVL Should Not Apply to Constant-Speed Engines

What Commenters said:

Cummins commented that the proposed constant-speed and variable-load procedure should be revised to be more representative of the majority of applications. Cummins also noted a willingess to work with EPA to develop a more appropriate test cycle for constant-speed engines.

Letters:
Los Angeles Public Hearing, A-2001-28, IV-D-07 [Cummins p. 36]

EMA and Euromot commented that EPA's corrected version of its "Arc Welder High Torque-Transient" cycle for testing constant-speed engines is inappropriate. This duty cycle is not representative of the use of the majority of constant-speed nonroad engines. While the transient tests for highway and variable-speed nonroad engines were based on duty cycles from multiple applications, the constant-speed transient test that is being considered was based solely upon the operation of a single, relatively small, naturally-aspirated arc welder engine, which has a very different operation and test cycle than the typical portable generator sets. The larger turbochargers used on many generator engines do not conform to the operational characteristics required by the proposed transient test and it is inappropriate to derive a constant-speed test cycle from a naturally-aspirated engine, since turbocharged engines will have difficulty conforming with the test requirements. In addition, the majority of the arc welder engines are actually variable-speed engines certified on the C1, 8-mode, steady-state test cycle, which should continue into the future since variable speed engines can more readily meet the severe needs of an arc welder as compared to specialized generator-drive engines. The commenters provided additional discussion on this issue and cited the following concerns regarding data based on arc welders: 1) the average load factor is much too low; 2) the frequency of the transient is much too high; 3) the amplitudes of the transients are too great, which leads to load application swings that are inconsistent with generator set functions; and 4) the rates of transient load increase and response are much too fast due to repetitive, sharp applications. The commenters also provided additional discussion on these and other issues related to the cost and feasibility of developing the transient test, and the emission contribution of the nonroad constant speed engine (see additional discussion below).

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 55-58
Euromot, OAR-2003-0012-0822, 0823 p. 10

DDC and EMA commented that there is inadequate justification for any transient certification testing of constant-speed engines. Nonroad constant-speed engines are narrowly focused on providing higher power capability at a single speed, while meeting the emission requirements. Larger, less-responsive turbochargers are used in enabling these engines to achieve the requisite higher brake mean effective pressure (BMEP). These engines are not designed to have the ability to react to the sharp transients experienced in many other applications. Having to meet emission requirements under operating conditions for which the engines are not inherently designed adds a level of unjustified complexity that makes both meeting the emission requirements and achieving needed performance levels much more difficult and costly.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 3
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 57-58

EMA commented that the emissions contribution from nonroad constant-speed engines is insignificant. The nonroad engines and vehicles that are considered "light commercial equipment" represent only 0.8 to 0.9 percent of PM emissions, which is due in part, to the fact that portable generator sets are only operated when emergencies occur. EMA believes that requiring these engines to be tested and comply with the standards under an inappropriate test cycle will be costly and burdensome, and will compromise engine performance.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 58

EMA commented that, for some engine manufacturers, as much as 90 percent of their nonroad-certified generator-set engines are actually used in stationary applications. An inappropriate test cycle for nonroad constant-speed engines, such as the proposed arc welder cycle, would compromise engine performance and would carry over to other generator set applications. This could contribute to a reduction in the voluntary use of nonroad certified engines in stationary applications, which could then negatively impact local air quality.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 58

EMA commented that aftertreatment requirements for PM negate the need for a transient test. Ensuring adequate control of engine-out PM emissions during transient engine operation has been the driving force behind the development and application of the transient test. However, PM filters successfully remove over 90 percent of the PM and are equally effective under transient and steady-state operating conditions. Therefore, steady-state testing of PM filter equipped engines is adequate to ensure PM control under all operating conditions. The in-use PM difference between engines with PM filters certified on the D2 steady-state test versus a transient test would not be measurable.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 58-59

Yanmar commented that the CSVL test is not representative of constant speed engines since it contains harsh fluctuations of load and the engine speed response is too high. The commenter provided data and an illustration comparing the duty cycle of CSVL and the general load pattern of constant speed engines to show that this test is not representative.

Letters:
Yanmar, OAR-2003-0012-0615, 0813 p. 7

EMA commented that any concerns regarding transient-load PM from aftertreated constant-speed engines should be adequately addressed with the expected NTE limits that would apply to the transient-load conditions for those engines.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 59

EMA commented that a unique test for constant-speed engines would amount to an unjustified break from the significant level of harmonization between the U.S. and Europe. The European Commission has not seen the need for a unique transient-load test for constant-speed engines.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 59

Our Response:

While the proposed CSVL cycle may not have been able to accommodate the particular operating parameters required to run every constant-speed engine, it is a fairly robust cycle for many types of constant-speed equipment and applications. However, as outlined in the Preamble, section III.F.3 and RIA chapter 4.2.7, EPA will not adopt its proposed CSVL cycle. Instead, the Agency will work with nonroad engine manufacturers and the EMA to develop a more appropriate test cycle(s) for all constant-speed engines which is (are) more representative of the variety of constant-speed applications. EPA hopes to complete this process in time for its 2007 Technology Review. The European Commission, by contrast, has endorsed EPA's proposed CSVL cycle as a unique transient-load test for constant-speed engines. We will maintain efforts to harmonize any new nonroad constant-speed duty cycles between Europe and the US.

As the RIA for this rulemaking notes, gensets comprise slightly over half the of the CSVL equipment population. The balance of the constant-speed equipment units come from more than ten application categories, ranging from pumps and light plants to cement mixers and shredders, and exhibit a range of transient load operation under limited speed changes. One issue we intend to investigate further is the possibility of a separate test cycle for generator sets.

As explained in section III.F.2 of the preamble, we are promulgating an immediate requirement of NTE testing for constant speed-variable load engines, which will provide some control in transient operation. However, as noted, our main plan for an appropriate test cycle for these engines is to develop a cycle in time for the 2007 Technology Review.

9.5.1.6 EPA Should Not Apply the NRTC Test to Engines below 37 kW

What Commenters Said:

Yanmar stated that there was general agreement on September 13, 2000 during the process of developing the NRTC to only apply it to engines between 37 and 560 kW. The commenter provided a copy of the "Terms of Reference" from this meeting as supporting documentation and reiterated its concern that the NRTC should not apply to these smaller engines. Further, Yanmar commented, CFR 89.410 allows the 8-mode test cycle to be used on variable speed engines below 19 kW as the exclusive testing mode for certification. Current applicability of the steady state cycle as the exclusive test cycle should not be changed.

Letters:
Yanmar, OAR-2003-0012-0615, 0813 p. 6, 7

Our Response:

As set out in the preamble, EPA is not aware of any technical reason that these smallest engines should not be subject to the NRTC test (along with steady state testing). Indeed, since these engines will not be subject to aftertreatment based PM standards, it is especially important to have a transient test cycle, since a) these engines indisputably have applications that are transient in nature, and b) the engine-out and DOC-based control on which the standard is based are significantly more operating mode-dependent than PM-filters. Thus, the original reason EPA developed the transient test cycle – inability of steady state nonroad steady state certification tests to capture a broad area of real world transient operating characteristics with consequent lack of assurance of PM control in use (see 63 FR at 56984) – remains true for these engines. Moreover, our data indicate that the 2008 PM standards for these engines using the NRTC are feasible. To date, EPA has received no engine data to show that these engines cannot run the NRTC, and we have in fact tested small engines over the NRTC with good results (see Section 4.2.8.2.2 of the RIA). Indeed, Yanmar has submitted data to the GRPE on NRMM (nonroad mobile machinery) on one of its own small engines which was run to good effect over the NRTC test cycle (memorandum-Cleophas Jackson to EPA Air Docket A-2001-28, II-B-170 "JRC December 5, 2001, Report on Cycle Performance."). Finally, the commenter is mistaken that EPA representatives stated at any time that the Agency would not adopt a transient test duty cycle for these engines. At the conference to which the commenter refers, (09-13-2000 meeting, Ann Arbor), EPA representatives only said that there would be no further discussion of the issue at that meeting.

9.5.1.7 EPA Should Eliminate the Transient Testing Requirements for Engines Greater than 560 kW (750hp)

What Commenters Said:

EMA commented that the proposed transient NRTC (or machine NRTC) is not representative of nonroad engine operation in large machines that use engines of more than a few hundred kilowatts. This test cycle has an average speed of 67 percent and average torque of only 39 percent. Data from a sample of large bulldozers and wheel loaders with engines greater than 560 kW show both an average speed and an average load of greater than 80 percent. The load and speed cycle for these large engines is much less transient than the proposed machine NRTC and it is unlikely that a large engine could ever respond as fast as shown for the machine NRTC due to the turbocharger lag with highly-boosted engines and the slower response of the large, high inertia turbochargers.

Generally, nonroad engines greater than 560kW are not representative of typical on-highway engines. The power range of this single category is over nine times larger than the entire power range for on-highway engines. Multi-stage turbocharging with dual exhaust is common for these larger nonroad engines. The exhaust flow for these engines may be up to 8 times higher than an average on-highway engine. By contrast, on-highway engines are typically in-line four or six cylinder engines with single-stage turbocharging with one exhaust pipe as the norm, unless split solely for cosmetic purposes.

The currently used ISO steady state test is much more representative of large engine operation in large machines than the proposed machine NRTC. In addition, building transient cells for engines greater than 560 kW would not make economic or technical sense since the number of engines is small and running a transient test with full dilution capability would require a significant test cell development program. No manufacturer or regulatory agency has built such a test cell and there is no established protocol that can be followed. Engine manufacturers' resources should be devoted to meeting the stringent standards proposed, and not in building cost-prohibitive test facilities and processes that will provide minimal, if any, environmental benefit.

<u>Letters:</u>
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 17, 23, 53-54, 111
DDC, OAR-2003-0012-0783 p. 4

Cummins and Komatsu commented that transient testing for both constant-speed and variable-speed engines should be limited to engines less than 750 hp. These large engines were not considered during the development and testing of the proposed cycle. To expand CVS test capability to over 3,000 kW, an excessive level of investment would be required. Cummins specifically noted that even with limited transient testing to engines less than or equal to 560 kW, it will be necessary to invest heavily to expand its existing CVS testing capability up to 560 kW for engines that fall outside the on-highway power range and that this investment will be approximately $3 to $4 million to upgrade only three test cells in one facility. The commenter also noted its willingness to work with EPA to establish whether an alternative to the complex and costly transient test might be suitable for measuring emissions from engines greater than 750 hp and recommends that EPA simply carry over the existing steady-state and smoke tests required in 40 CFR Part 89 and rely on the proposed NTE requirements to ensure that emissions are controlled during transient operation. Komatsu added that the excessive costs are not justified given the small production volume of these larger engines. The commenter further noted that its annual production volume for the U.S. over-560 kW market is approximately 10 units annually, or just 0.3 percent of the total U.S. sales volume and recommends that modal testing be used for this engine category, which should be sufficient since large engines often have operating cycles that do not reflect transient operation.

Letters:
Cummins, Inc., OAR-2003-0012-0650 p. 5-6
Komatsu, OAR-2003-0012-0455 - 0457 p. 1-2
Los Angeles Public Hearing, A-2001-28, IV-D-07 [Cummins p. 36]

Caterpillar and Euromot commented that the systems to conduct transient testing on engines over 750 hp have not been developed and are expected to be extreme in both cost and size with very little benefit to the overall goal of reducing emissions. Current test cells only have the capability to test engines up to 600 hp and would need to be redesigned and developed to handle any power levels above their current limits. It is unknown how much additional capacity could effectively be added to current cells, but it is known that transient test cells for engines above 750 hp cannot be built in a cost-effective manner. Caterpillar provided additional discussion and details on the feasibility, space requirements, and cost of certifying an engine up to 3,500 hp, and concluded that a reasonable starting estimate for a cell of the required capacity is $20 million based on its Technical Center experience. The commenter also added that designing a dynamometer required to provide the load for a transient test has never been attempted and the cost would be in the range of $1.6 million, which would rise to approximately $3 million when test cell modifications are made to accept such a large dynamometer.

Letters:
Caterpillar, Inc., OAR-2003-0012-0812 p. 2-3
Euromot, OAR-2003-0012-0822, 0823 p. 10

Our Response:

At this time, the Agency is not adopting a transient emission testing requirement for engines 560kW and over. EPA sees the significant burden an additional transient duty cycle test would put on these very large displacement engine manufacturers. New transient test requirements could require manufacturers to create new or expanded testing facilities to house, prepare and run transient tests on these larger engines. Absent transient testing, these engines will be required to certify to both steady-state testing and NTE requirements. The combination of steady-state and NTE testing is expected to effectively cover the range of operation that these engines might encounter in-use. For NTE, manufacturers of >750 hp engines will have to submit data and/or an analysis at certification that demonstrates that their engines meet the Tier 4 NTE requirements. This may involve equipping engines with diesel particulate filters having either active or passive back-up control systems. However, the Agency will not require manufacturers to use partial-flow sampling systems (PFSS) to determine PM emissions from their engines for certification. Manufacturers may choose to submit PM data to the Agency using PFSS as an alternative test method, if that manufacturer can demonstrate test equivalency.

Were transient testing an additional requirement of this class of engines, the exceptional costs of that testing on such a large scale might far outweigh the relatively small additional savings in emissions to be found over a transient duty cycle. Engines in this power category are found in a relatively small proportion of the nonroad equipment population and units equipped with these engines have likewise been noted to contribute a small proportion of total diesel nonroad engine emissions. Many of these larger-displacement engines operate predominately in a constant-speed fashion with few transient excursions, as with electric power generation sets, which make up a significant percent of these larger engines. Many of these constant-speed engines, too, operate on an intermittent or stand-by only basis.

9.5.1.8 EPA Should Adopt the Partial Flow Dilution System an Option for Transient and Steady State Testing

Euromot and Lister Petter commented that the sole use of CVS (Constant Volume System) full flow dilution systems for emission measurements preferred by EPA could be costly and burdensome. Euromot specifically recommended in this context, that EPA maintain its proposal to adopt ISO Standards 8178-1 and ISO 8178-11 by reference.

Letters:
Euromot, OAR-2003-0012-0822, 0823 p. 11
Lister Petter, OAR-2003-0012-0155 p. 1

Komatsu commented that the current PM measurement technique specified in 40 CFR Part 89 refers to the California test procedures, which in turn refer to the ISO 8178-1 procedures that allow use of a partial dilution tunnel. However, the test procedure for Tier 4 (see Section 1065.115) refers to 40 CFR Section 86.1310, which is based on the full dilution approach. This change in measurement procedure will require yet another huge investment for large engines greater than 560 kW. EPA should continue to allow the partial dilution tunnel approach.

Letters:
Komatsu, OAR-2003-0012-0455 - 0457 p. 2

Our Response:

We will continue to allow engine manufacturers to certify using partial flow sampling techniques and bag/batch raw gas sampling for steady state operation. Should a manufacturer certifying to EPA standards using transient certification duty cycles which to certify using partial flow sampling techniques, that will be allowed under the provisions of 40 CFR §1065.12.

9.5.2 Cold-Start Testing

9.5.2.1 Supports Use of Cold-Start Testing

What Commenters Said:

CARB, NRDC, and STAPPA/ALAPCO commented that given that future Tier 4 engines will use catalytic devices for the first time, cold-start testing is critical. EPA's proposed weighting of the cold-start emission test (1/10 of the total) is reasonable. Additionally, the commenters noted, the European Commission felt that a cold start with a weighting of 10% (1/10 of the total) was appropriate and provided its technical defense of the weighting.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 10
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 29
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 13

A number of additional commenters stated that they support cold-start testing, but provided no additional discussion or supporting documentation.

Letters:
Environmental Defense, OAR-2003-0012-0821 p. 10
NESCAUM, OAR-2003-0012-0659 p. 7
Pennsylvania Department of Environmental Protection, OAR-2003-0012-0699 p. 4
Union of Concerned Scientists, OAR-2003-0012-0830 p. 8
New York Public Hearing, A-2001-28, IV-D-05 [CARB p. 144; NRDC p. 31]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [CARB p. 19]
European Commission, OAR-2003-0012-0934

Our Response:

EPA agrees with the commenters that cold-start testing will be a valuable addition to the nonroad engine transient emissions testing requirements. Unlike steady-state tests, which always start with hot-stabilized engine operation, transient tests come closer to simulating actual in-use operation, in which engines may start operating after an extended soak period, i.e., cold-start. With this new transient test and manufacturers' expected use of catalytic devices to meet Tier 4 emission standards, it is imperative to address cold-start emissions in the measurement procedure. EPA's test procedure will require measurement of both cold-start and hot-start emissions over the transient duty cycle, much like that for highway diesel engines. Also, we intend to apply a cold-start requirement when we adopt a transient duty cycle specifically for engines certified only for constant-speed operation. We believe a 5-percent weighting of cold-start emissions addresses the need to design engines to minimize emissions under cold-start operation. Manufacturers will be able to take steps to minimize the testing burden by taking advantage of provisions that allow for forced cooling to reduce total testing time.

9.5.2.2 Does Not Support Cold-Start Testing

What Commenters Said:

DDC and EMA commented that cold-start testing doubles the amount of testing that must be done for certification and auditing, and also increases the amount of development testing, without any demonstrated need or emissions benefit. In addition, it necessitates that the engine/aftertreatment system be equilibrated with the test cell room temperature before initiating the cold-start test, which can take several hours during which the test cell cannot be used. As a result, this requirement will be burdensome and costly by reducing operating efficiency of test facilities and extending the time for testing programs.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 3
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 61-62

DDC and EMA also commented that EPA has failed to account for cold-start emissions in the feasibility analysis and in setting the proposed emission standards. For example, in the 75 to 560 kW power categories, EPA assumes NO_x aftertreatment systems that are approximately 90 percent efficient will be applied to engines meeting the Tier 3 NO_x standard. EPA acknowledges that 90 percent is likely to be the peak efficiency, which will be reduced at lower temperatures. However, the cold-start requirement evaluates emission performance before the NO_x adsorber has reached its peak efficiency. EPA should not set standards based on the assumption of aftertreatment systems operating at or near peak efficiency, while at the same time, requiring manufacturers to meet the standards under cold-start test conditions that cause the aftertreatment system to be below its effective operating temperature.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 3
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 62

DDC and EMA commented that a prescribed warm-up operating sequence to bring the aftertreatment systems up to normal operating temperature in a standardized way in combination with elimination of the cold-soak requirement, as in Part 1048, would be preferable. However, they stated, EPA should consider a more flexible approach that would allow the manufacturer to use any convenient operating sequence for warm-up with reliance on catalyst temperature measurements to determine when the catalyst is adequately warmed up. Under this approach, the test procedure would include a warmup segment in which the engine would be operated in any manner until all of the catalysts reach their "light off" temperatures, at which point the transient test cycle and emissions measurements would commence after 30 seconds at idle. To avoid excessive warm-up operations, EPA could add a provision requiring that if the aftertreatment system does not achieve the "light-off" after 10 minutes at rated speed and 50 percent load operation then the emission testing would begin after the aftertreatment system had warmed up to the catalyst temperature that is achieved after the catalyst has stabilized at room temperature and then warmed-up through operation of the engine for 10 minutes at rated speed and 50 percent load. Also, as part of the certification process, manufacturers would report all AECDs that would be active during engine warm-up, which could be evaluated to determine if they are defeat devices. This approach provides parity with the way nonroad SI engines are treated and avoids the burdensome and inefficient cold-start requirements.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 62-63

EMA noted that as justification for the cold-start testing provisions, EPA used data from 40 pieces of nonroad equipment operating over an "average" workday. EPA should provide information on how it determined an "average" workday and how the subset (13 pieces of equipment, none of which used aftertreatment) were selected from the available data set of 40. Power categories of the engines in the sample were not disclosed and it remains unclear whether the 13-engine sample reflects all of the power categories covered by the proposed rule.

Letters:

Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 60

EMA also commented that the 10 minutes and 1 hour time period used to define cold-start operation appear to have been chosen arbitrarily and not to have been based on actual warm-up and cool down time periods. Only the smallest of engines will cool off to ambient temperature within an hour's time. Engines in most power categories will take several hours to cool off to ambient temperature. EMA also noted that its cool down data based on engines in the 6 to 19 liter size range indicate that engine coolant has only cooled down about 25 percent of the way to the ambient temperature one hour after a shutdown and that to cool down fully requires over 8 hours.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 60

EMA commented that EPA determined that the "cold-start' NO_x emissions for the different pieces of equipment ranged from 1.8 to 9.7 percent with an overall average of 4.4 percent. However, EPA then chose to weight cold-start emissions by 10 percent. EPA should provide an explanation for how the 4.4 percent average translates to a 10 percent cold-start weighting. (See additional discussion above regarding the appropriateness of the cold-start testing provisions in light of this discrepancy).

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 60-61

DDC and EMA commented that the 10 percent cold-start weighting factor is excessive. EPA's own analysis based on NO_x percentages indicates a factor of 4.4 percent, not 10 percent as EPA has proposed. An improved analysis of these data using a more realistic assumption would show that the percent of cold operation is much lower. EPA states that emissions during the cold-start operation were generally greater than during "warmer" operation. However, this statement is contradicted by the data presented in the RIA (Table 4.2-15). EPA concludes that 4.4 percent of the NO_x emissions were generated under the presumed cold-start conditions, but on a time basis, the data from the 13-engine test sample show that the engines were presumed to be operating in cold-start mode 4.1 percent of the time. The small difference between 4.1 and 4.4 percent suggests that the NO_x emission rate during cold starting is essentially the same as after the engine is warmed up and does not appear to support EPA's assertion that emissions were appreciably higher during cold start. (See related comment below regarding the need for further explanation on this issue).

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 3
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 62

EMA commented that EPA made a technical error when it included measured NO_x emissions in the analysis to determine the weighting factor. The relevant parameter for determining the weighting factor is not the fraction of emissions produced during cold start, but the percentage of operating time that the engine spends during warm-up.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 61

EMA commented that In analyzing its database, EPA should base its definition of cold start on a functional parameter such as temperature difference between engine coolant and ambient instead of arbitrary time parameters. This would show that the fraction of cold operation time would be much less than 4.1 percent. Even though the requisite temperature data may not be available to complete this analysis, EPA's analysis should certainly be redone using the more realistic assumption that cold-start operation only occurs on start-up after a shut down of more than 4 hours, which may in fact show that there is no need for cold-start testing.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 61

Euromot commented that EPA's estimate of the cold-start portion of engines used in nonroad applications at 4 percent is too high. Given such low numbers, the resulting burden for testing is unreasonably high in terms of cost and test equipment capacity. Euromot believes that EPA should eliminate this requirement.

Letters:
Euromot, OAR-2003-0012-0822, 0823 p. 10

EMA commented that engines in the greater than 560 kW power category may require a natural "soak back" time as long as 24 hours in order to meet the cool down requirements of Part 86. On very large engines, temperatures may be unequal along the length of the engine making it difficult to bring the entire engine within the cool-down specifications of Part 86. In addition, true cold starts occur infrequently and warm-up is a very small percentage of total operating time. In many cases, larger engines are equipped with internal heater systems that maintain coolant and oil temperature at elevated temperatures even during extended shutdowns. Thus, cold-start tests are particularly inappropriate and problematic for these larger engines.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 63-64

Komatsu commented that cold-start testing should not be required for engines greater than 560 kW. Preparing for a cold-start test requires a long stabilization period, especially for large engines. Large nonroad machines may not be operated under frequent start-stop conditions. Cold-start testing would be least suitable for engines used in large mining machines, which are operated 20 to 24 hours per day in 2 to 3 shifts, with no cool down or shut down period.

Letters:
Komatsu, OAR-2003-0012-0455 - 0457 p. 3

Our Response:

The following sections respond to the various comments related to cold-start testing, first for engines below 560 kW, then for the larger engines.

The need for cold-start testing

Nonroad diesel engines typically operate in the field by starting and warming to a point of stabilized hot operation at least once in a workday. As described in Section 4.2.9 of the Final Regulatory Impact Analysis, measurements have shown that engines have higher emissions during cold-start operation than after warm-up. We have observed that certain test engines, which generally had engine-based emission-control technologies for meeting Tier 2 or Tier 3 standards (without aftertreatment), had elevated emission levels for about 10 minutes after starting from a cold condition. The extent and duration of increased cold-start emissions will likely be affected by changing technology for meeting Tier 4 standards, but there is no reason to believe that this effect will lessen. The concern is especially pronounced with respect to catalytic devices used for NOx control, because many require heating to a "light-off" or peak-efficiency temperature to begin working. NOx adsorbers, the aftertreatment technology on whose performance many of the NOx standards in this rule are based, are an example. (In contrast, particulate traps generally work with equal effectiveness under cold-start conditions.) EPA's highway engine and vehicle programs, which increasingly involve such catalytic devices, seek to ensure that these emissions are both considered and controlled to the greatest degree achievable by specifying a test procedure that first measures emissions with a cold engine, then repeats the test after the engine is warmed up, weighting the emission results from the two tests for a composite emission measurement. Unlike steady-state tests, which always start with hot-stabilized engine operation, transient tests come closer to simulating actual in-use operation, in which engines may start operating after only a short cooldown (hot-start) or after an extended soak (cold-start). The new transient test (NRTC) and manufacturers' expected use of catalytic devices to meet Tier 4 emission standards make it imperative to address cold-start emissions in the measurement procedure. We therefore believe it is necessary to adopt a test procedure that requires measurement of both cold-start and hot-start emissions for engines that are subject to testing over a transient duty cycle, much like for highway diesel engines. We further believe that commenters are mistaken in implying that the cold-start testing adds unnecessary costs without commensurate environmental benefit. We have determined that the overall costs of the rule are reasonable, and specifically included the costs of cold-start testing in that assessment.

Weighting factor

Several comments centered around the analytical approach we used to establish the extent to which cold-start measurements would be weighted in the composite emission measurement. We agree with several of the objections raised. In particular, we believe it is not appropriate to calculate a weighting factor based on the overall contribution of NOx emissions during cold operation, since the extent to which cold start emissions should be weighted logically turns on the duration the engine is operating under cold start conditions. We also understand the concern implicit in the comments that the data underlying our analysis was insufficient to support the proposed weighting factor. Engines operate in many different types of equipment, each with varying operating characteristics. An ideal assessment would require data collection from a wide range of engines to evaluate how frequently cold-start conditions occur. Finally, we agree that the engine downtime that constitutes a long enough soak period to establish cold-start conditions for analytical purposes should be consistent with the soak period specified in the test procedure to prepare for the cold-start test. For example, defining a cold-start as operation following a one-hour soak would correspond with a requirement to soak the engines for as little as one hour before starting the cold-start test, which, as commenters pointed out, would be unrepresentative of and inadequate for many larger nonroad diesel engines.

It is important to point out, however, that we disagree with one aspect of manufacturers' recommended approach to determining a cold-start weighting factor. While manufacturers aim for calculating a precise average value, this is not consistent with our general approach for adopting test procedures. Test procedures should be designed to ensure effective emission control under the wide range of ambient conditions and operating characteristics that occur in use. Designing a test to simulate average conditions would (by definition) leave engines unable to control emissions under many real conditions that are more severe than average.

Given the need to take a different approach to establishing a cold-start weighting factor, we are taking the approach of adopting a weighting factor in this final rule based (as one commenter urged) on a simple assessment of typical engine operation. We intend to revisit this issue in the future to more carefully evaluate actual in-use operation for defining an appropriate weighting factor.

As described further below, we believe it is appropriate to require a fully stabilized cold-start for laboratory testing, rather than changing the test procedure to conform with the one-hour soak period embedded in the analysis supporting the proposed rule. This ensures that the test procedure evaluates conditions at which emissions from cold-start testing will be highest. Accordingly, we believe it is appropriate to define a cold-start weighting factor based on the frequency of an engine starting operation after an extended time of not operating. As manufacturers point out, a full cooldown for many engines may require eight hours of down time. As such, the analytical exercise simplifies to an evaluation of an engine's total daily operating time, since there is generally a cold-start after eight hours of down time only at the start of a workday. We are basing our final weighting factor on seven hours of operation per day. We believe this value can be properly characterized as typical. This generally equates to 3-4 hours of operation in the morning, followed by a lunch break and 3-4 additional hours of operation in the afternoon. Seven hours of operation per day would correspond with a cold-start weighting factor of 5 percent (similar to the weighting factor of 4.4% recommended in a number of the comments). This calculation results from dividing the cold-start measurement portion (20 minutes) by total daily operation (420 minutes).

We believe this 5-percent weighting is based on a reasonable assessment of typical in-use operation (and thus disagree with the commenter suggesting that even a 4-percent weighting factor would be too high) and ensures that manufacturers will design their engines to control emissions under cold-start operation. This is true without regard to whether typical cold-start operation is actually higher or lower than 5 percent. Given the low levels of the Tier 4 standards, manufacturers will optimize their engines to minimize cold-start operation (and thus reduce emissions) to the greatest extent possible.

Test burden

As pointed out by the commenters, cooling an engine down takes several hours. Testing engines after they have fully cooled down ensures that an engine's emission-control system will be adequately tested to ensure proper operation from the initial operation following engine starting. We realize that focusing on a full cooldown for cold-start operation requires that we calculate a smaller cold-start weighting factor, as described above. We nevertheless believe it is more important to properly simulate cold-start operation in the test procedure, since this captures the type of operation that involves the greatest need for cold-start emission control. Shortening this soak period to measure cold-start emissions from an engine that has not fully cooled off would undermine the objective of cold-start testing. While a full overnight soak to prepare engines for a cold-start transient test could indeed be burdensome, the proposal included provisions that would allow manufacturers to substantially shorten this time by accelerating the engine cooling using laboratory techniques (external fans, special cooling devices, etc.)

and we have adopted these provisions in the final rule. The estimated costs for testing related to meeting the Tier 4 emission standards take into account the lab time necessary to conduct testing with the cold-start provisions in the final rule.

Alternative approach

Engine manufacturers recommended an alternative approach to addressing cold-start testing—using the "warm-start" procedure we adopted for nonroad spark-ignition engines, but with changes that would allow aftertreatment devices enough time to fully warm up. We believe these changes would undermine the whole purpose of cold-start testing. Instead of defining a clear target for minimizing cold-start emissions, the alternative test conditions suggested by manufacturers would make the test procedure incapable of addressing the need to control emissions under the situations where control could be most important.

Moreover, the "warm-start" we adopted in the earlier rule is tailored to the specific characteristics of spark-ignition engines and their emission-control technologies. Spark-ignition engines generally use three-way catalysts, which have a warm-up time that is well understood. Limiting the warm-up period to three minutes and requiring manufacturers to describe how they reach closed-loop operation as early as possible during those three minutes is an appropriate way of addressing the primary variable that affects cold-start emissions from spark-ignition engines. In contrast, diesel engines typically have higher engine efficiency, higher thermal mass, and run at leaner air/fuel ratios. The combined effect of these differences is that it may take much longer to reach a stabilized operating condition such that emission-control systems are fully functioning. There are steps manufacturers can take to speed up a diesel engine's ability to control emissions after startup, but we will only expect them to take these steps if testing starts with a cold engine. We have therefore concluded that the warm-up procedures in 40 CFR part 1048 would not provide a sufficient incentive to reduce cold-start emissions for diesel engines and are opting instead to base cold-start testing on the proposed approach.

Feasibility

See Section 4.1 of the Final RIA for a discussion of our basis for believing that the Tier 4 emissions standards are feasible for engines when operating over the transient test with the test procedures, including cold-start weighting factor, described above. See particularly "How effective are NOx adsorbers for cold-start emissions" in RIA Section 4.1.2.3. In general, we believe that manufacturers can take steps to accelerate the warm-up of aftertreatment devices and reduce the time needed to start controlling emissions effectively. We therefore believe that cold-start testing is necessary and that controlling these emissions is an aspect of ensuring that emissions are controlled to the greatest degree achievable. We also disagree with the argument that the NOx standard is not feasible because NOx adsorbers are 90 percent efficient and NOx adsorbers cannot operate at 90 percent efficiency during cold-start testing, thus pulling the overall efficiency below 90 percent. NOx adsorbers generally have an average efficiency of 90 percent. We fully expect performance above 95 percent during portions of the transient test unaffected by cold-start concerns to balance out the cold-start portion so that the NOx standards are achievable.

Engines over 560 kW

We are not finalizing a requirement to test engines over 560 kW using transient testing procedures. Since cold-start testing occurs only in the context of the transient test, issues related to implementation of cold-start testing requirements for these engines do not apply. We remain concerned that these larger engines have emission-control systems that function effectively during cold-start conditions. Absent a test procedure to measure cold-start emissions, we are relying on the prohibition of defeat devices to prevent manufacturers from designing or producing their engines in a way that would compromise emission control during operation following a cold-start condition. If in-use testing shows that cold-start emissions are more problematic that we currently understand, we would expect to pursue a more effective means of addressing emission controls for cold operation.

9.5.3 Control of Smoke

9.5.3.1 Commenter Supports EPA's Proposed Smoke Test Requirements

What Commenters Said:

STAPPA/ALAPCO commented that the current smoke test procedure from Part 86, Subpart I does not provide data comparable to the most practical in-use smoke test procedure, a snap-idle acceleration test with measured opacity. Data from an ISO 8178-9, which EPA has proposed to use in this rule, can provide the desired link. EPA should maintain the proposed smoke test procedures in the final rule, but should carry out the necessary testing to establish the desired link.

<u>Letters:</u>
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 14

NESCAUM commented that the proposed smoke procedure is superior to the on-highway procedure it supercedes, since it is specific to nonroad engines. It will also contribute to harmonization of nonroad engine certification between the U.S. and Europe, which is important since many nonroad engine manufacturers develop and market a singular "worldwide" product.

<u>Letters:</u>
NESCAUM, OAR-2003-0012-0659 p. 7

NRDC commented that, in addition to the improved smoke testing procedures, EPA should develop guidance for states that wish to develop improved I&M programs for highway and nonroad engines. A critical omission from the nation's oversight of diesel engines is the continuing reliance on opacity-based I&M programs in those states that have I&M program for heavy duty vehicles and the complete absence of any state I&M programs for nonroad diesel engines.

<u>Letters:</u>
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 29-30

The Pennsylvania Department of Environmental Protection commented that it supports EPA's proposed smoke test requirements, but provided no additional discussion or supporting documentation.

<u>Letters:</u>

Pennsylvania Department of Environmental Protection, OAR-2003-0012-0699 p. 4

Our Response:

As we see in-use testing methods continue to develop, it is becoming clearer that the best way to evaluate whether in-use diesel engines have high smoke or PM emission levels is to use PM-measurement technologies for testing in the field. In the long term, we are depending on the Tier 4 PM standards, with verification of control under an in-use testing program, to adequately address both smoke and PM emissions from nonroad diesel engines. As result, we believe it is best to continue to rely on the established smoke testing procedures, rather than pursuing the proposed approach. To control smoke emissions, we are therefore requiring that the current smoke standards and procedures will continue to apply. By keeping the existing smoke testing standards and procedures, we fully address all the additional technical concerns raised by commenters.

We have resolved the inconsistent language in the proposed regulatory and preamble text by saying for the final rule that engines that are exempt from smoke requirements are exempt from the standards, not only from the testing and data-submission requirements.

9.5.3.2 EPA's Proposal to Replace the Federal Smoke Procedure Should Not Be Finalized

What Commenters Said:

DDC commented that EPA should eliminate smoke requirements for Tier 4 engines. Moreover, DDC and EMA commented that proposal to replace the present Federal Smoke Procedure with the ISO 8178 Part 9 nonroad smoke procedure, with revised numerical limits, should not be finalized. The ISO smoke procedure is problematic for many reasons including the following: 1) the ISO test was designed to be a test that could be correlated to field inspection, but since then, in-use measurement systems (e.g. ROVER, SPOT, and PEMS) have been developed, 2) ISO was developed under the false assumption that the anticipated amendment to 97/68 would include smoke, 3) there has been no concerted effort to develop smoke correlation on a variety of engines and no round-robin testing to prove out the proposed ISO procedure. The ISO procedure should be adopted as an acceptable alternate or optional procedure but not as the sole allowable test.

<u>Letters:</u>
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 6
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 67-69

EMA and Komatsu commented that the ISO smoke procedure is intended to be run with the dynamometer decoupled from the engine to perform the free acceleration test (FAT). Because the dynamometer is decoupled, engines would need to be started with the use of an electric or air starter, neither of which are commonly supplied with the test engine. The tests also require the engine to be preconditioned at rated power prior to initiation of the FAT. A FAT on an engine over 560 kW is completely unrepresentative of the way these engines are operated in use. In addition, the issue of choosing the appropriate flywheel for the FAT test can become an important and complex issue that is better off avoided given the marginal benefit of a smoke test. EPA should allow manufacturers to use the current smoke test procedures, which are not influenced by flywheel inertia, so that multiple testing can be avoided.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 68-69
Komatsu, OAR-2003-0012-0455 - 0457 p. 3-4

CNH Global commented that, since the new smoke requirement based on ISO-8178-9 does not apply for PM limits below 0.07 g/kW-hr, it will only be in force for a limited amount of time for most engine models. CNH also noted that with the inevitable teething problems and related costs, it is not justified and as a result, the European Union is not pursuing it.

Letters:
CNH Global, OAR-2003-0012-0819 p. 9

Komatsu commented that in Section 1039.235(g), engine manufacturers are not required to provide smoke emission data in the application for a certificate of conformity for engines having a PM certification level or FEL less than 0.07 g/kW-hr. However, there is no statement that such engines are exempt from smoke testing. The last sentence in this section should be modified to state explicitly that engines with PM emissions below the 0.07 g/kW-hr standard are "exempt" from smoke testing, as stated in the proposed preamble at Section VII.F.3.

Letters:
Komatsu, OAR-2003-0012-0455 - 0457 p. 3-4

EMA commented that even though EPA states that a FAT limit of 20 percent opacity is being proposed, a standard of 22 percent opacity is given in section 1039.105. It is also unclear when the proposed standard is to take effect and what engines are covered. The proposed regulations do not indicate if the standard applies to interim or final Tier 4 engines, phase-out engines, or engines using the split family option. While the preamble indicates EPA's intent to exempt single-cylinder engines and engines with a PM level of less than 0.05 g/hp-hr from the smoke requirements, no such exemptions were included in the proposed regulatory language.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 68-69

Our Response:

As we see in-use testing methods continue to develop, it is becoming clearer that the best way to evaluate whether in-use diesel engines have high smoke or PM emission levels is to use PM-measurement technologies for testing in the field. In the long term, we are depending on the Tier 4 PM standards, with verification of control under an in-use testing program, to adequately address both smoke and PM emissions from nonroad diesel engines. As result, we believe it is best to continue to rely on the established smoke testing procedures, rather than pursuing the proposed approach. To control smoke emissions, we are therefore requiring that the current smoke standards and procedures will continue to apply. By keeping the existing smoke testing standards and procedures, we fully address all the additional technical concerns raised by commenters.

We have resolved the inconsistent language in the proposed regulatory and preamble text by saying for the final rule that engines that are exempt from smoke requirements are exempt from the standards, not only from the testing and data-submission requirements.

9.5.4 TRU Cycle

9.5.4.1 Supports the Proposed TRU Test Cycle

What Commenters Said:

EMA commented that EPA's proposed new test cycle for TRUs is more representative of refrigeration unit operation than the current nonroad cycle. TRUs have a unique operating cycle since they do not operate at low idle, high idle, peak torque or rated power. The proposed TRU test cycle reflects these facts a provides an accurate assessment of the emissions from these units, and EMA stated that it supports the proposed TRU test cycle.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 25, 111

NRDC and NESCAUM commented that they support the proposed TRU test cycle, and believe that it will help improve the certification process.

Letters:
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 28
NESCAUM, OAR-2003-0012-0659 p. 7

Ingersoll-Rand commented that it supports the proposed TRU test cycle, but provided no additional discussion or supporting documentation.

Letters:
Ingersoll-Rand, OAR-2003-0012-0504 p. 19

CARB, STAPPA/ALAPCO, and UCS commented that they strongly support the use of this optional cycle but raise the concern that the proposal contains some usage restrictions that may inadvertently exclude most TRU engines from qualifying to use the cycle. EPA should reconsider the restrictions in paragraphs (d)(2), (e)(2), and (e)(3) of section 1039.645 to include allowances such as a transitional period of operation between modes that is characteristic of TRU engine operation and to increase the tolerance for fluctuations in engine speed and load while in any given test mode. EPA should work with CARB, which developed the cycle, to address these concerns.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 10-11
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 14
Union of Concerned Scientists, OAR-2003-0012-0830 p. 8
New York Public Hearing, A-2001-28, IV-D-05 [CARB p. 143]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [CARB p. 19]

Our Response:

EPA agrees that its TRU cycle can be more representative of transport refrigeration unit operation than the current nonroad steady-state 8-mode duty cycle and has taken pains to craft the definition of a TRU engine in such a way as to limit the cycle's broad application to the constant-speed engine category. EPA has however included allowances for engine parameter "drift" from an engine's operation in mode and has increased the tolerance for fluctuations in engine speed (less than 2 % on a second-by-second basis) and load (10% over an hour's operation) while in any given test mode.

9.5.4.2 EPA Should Strengthen the Procedures for the Optional Steady-state Transportation Refrigeration Unit (TRU) Test Cycle

What Commenters Said:

The New York Department of Environmental Conservation commented that truck refrigeration units are of particular concern since they are frequently co-located in large numbers in and around metropolitan areas, and they amount to a significant local air pollution source. In response, NY DEC has developed a specific test procedure for these engines.

Letters:
New York Public Hearing, A-2001-28, IV-D-05 [NY DEC p. 13]

CARB commented that the proposal excluded most transportation refrigeration unit (TRU) engines from the testing procedures. EPA should refine the portion of the proposal that addresses the optional steady-state TRU test cycle, which currently includes four modes to match real work conditions. The commenter noted that they have been collecting data on this issue that may be helpful to EPA in developing a more refined proposal that would encompass all TRUs.

Letters:
New York Public Hearing, A-2001-28, IV-D-05 [CARB p. 143]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [CARB p. 19]

Our Response:

EPA has worked with both Cal-EPA ARB and TRU engine manufacturers in making changes to the TRU engine parameter and variability-in-mode limits that EPA had proposed for in its TRU equipment regulations. The Agency does not believe that its TRU cycle is exclusive of engines from any sector which may operate in the real world as mobile transport refrigeration units.

9.5.4.3 EPA Should Modify Section 1039.645(e)(2) to Account for TRU Equipment

What Commenters Said:

Thermo King commented that in Section 1039.645(e)(2), the statement "Engine operates in any mode not covered by the test cycle described in this section, except for negligible transitional operation between two allowable modes" would exclude all TRU equipment manufactured by Thermo King and Carrier because TRU equipment has a slowly varying load dependent on the temperature of the evaporator and the condenser. A possible change to the observed torques would be to add a tolerance band within which the refrigeration equipment could operate. The commenter suggested specific tolerance bands based on its measurements of actual TRU equipment as follows: MODE 1: Maximum test speed, 75 percent + 20 percent/-12.5 percent observed torque; MODE 2: Maximum test speed, 50 percent +/- 12.5 percent observed torque; MODE 3: Intermediate test speed, 75 percent +/-12.5 percent observed torque; and MODE 4: 50 percent + 12.5 percent/-20 percent observed torque. This commenter also provides additional data measurements that show the hp range of their equipment.

Letters:
Thermo King Corp., OAR-2003-0012-0406 p. 1

Our Response:

EPA recognizes that a minimal amount of time is necessary to transition between modes and has modified the “negligible transitional operation” definitions applicable to Sections 1039.645(e)(2) and (3) of its TRU regulations to be more representative of the operation of TRUs in-use. These sections now allow for a drift, or “drop-off”, of less than 2% in ten minutes or less than 15% in engine load over the course of one hour after achieving a particular operating mode. Further, engine speed and load cannot vary by more than 2% on a second-by-second basis. These changes should address the variability TRU manufacturers have told EPA is inherent in the operation of their engines.

9.5.4.4 There Is No Need to Require a Special Governor for TRU Engines

What Commenters Said:

Yanmar commented that EPA is proposing that the engine sold in a configuration that allows for the engine to operate in any mode not covered by the TRU test cycle is not a TRU engine (see Section 1039.645(e)(3)). This provision attempts to avoid cases where certified TRU engines can be installed into equipment other than a TRU. However, TRU engines are required to have a long maintenance interval for lube oil and in order to meet this requirement, the oil sump for the TRU engines is shaped very differently and has an increased lube oil volume as compared to general nonroad engines. Therefore, it is impossible to install a TRU engine into any equipment other than a TRU. Yanmar provided an illustration comparing the configuration of a TRU engine to a general nonroad engine.

Letters:
Yanmar, OAR-2003-0012-0615, 0813 p. 8

Our Response:

The governor point raised by this commenter relates to the part of the definition of a TRU engine under these regulations, defining the engine type by its limited operation. The point raised by this commenter simply reinforces the definition as adopted by noting further constraints to the operation of a TRU engine in-use. This section, 1039.645(e)(3) will remain but EPA has modified the section to more accurately describe and limit the allowable excursions available to a TRU engine in-use. These sections now allow for a drift, or "drop-off", of less than 2% in ten minutes or less than 15% in engine load over the course of one hour after achieving a particular operating mode. Further, engine speed and load cannot vary by more than 2% on a second-by-second basis.

As an additional way of ensuring that TRU certification is limited to those engines for which it is warranted, we are adding a requirement that any TRU-certified engine must meet appropriate NTE standards for any in-use operation. This is limited neither to later model years nor to any particular range of engine speeds and loads. If TRU engine operation is limited as much as manufacturers have described, the resulting "NTE zone" should be practically limited to a narrow range of speeds and loads very close to those points represented by the specified duty cycle and can therefore be applied immediately (i.e., starting in 2008) as a certification test.

9.5.5 Other Test Procedure Issues

9.5.5.1 Generally Supports the Proposed Certification Test Procedures Changes

What Commenters Said:

NRDC commented that the proposed certification test procedures will improve testing precision, especially with regards to sampling methods.

Letters:
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 28

MECA commented that the proposed emission test procedures will reflect real world emission performance.

Letters:
Manufacturers of Emission Controls Association, OAR-2003-0012-0810, 0811 p. 11

Our Response:

We agree with these comments and are finalizing the proposed changes to the test procedures.

9.5.5.2 Testing and Measurement Standards Should Be Aligned Internationally

What Commenters Said:

Euromot commented that it would be burdensome to test engines in the United States to SAE or ASTM standards and also test engines in Europe and Japan according to ISO standards. EPA should investigate options for ensuring that testing standards are consistent.

Letters:
Chicago Public Hearing, A-2001-28, IV-D-06 [Euromot p. 236]

EMA and CNH commented that EPA's proposal to conduct steady-state tests with all emissions related engine control variables in the maximum NO_x-producing condition which would be encountered for a 30-second or longer averaging period at a given test point would be inconsistent with international standards. This requirement is not included in the ISO 8178 Part 1 or Part 4 test procedures or in the Japanese JMLIT test procedures for the NRMM. The steady state test requires variable emissions related settings to be set at maximum, which is not in line with ISO-8178 parts 1 and 4 and should be deleted from the requirements.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 64
CNH Global, OAR-2003-0012-0819 p. 9

EMA commented that EPA should not abandon efforts to date on the development of improvements to the test procedures and simply adopt all of ISO 8178-1 or 8178-11 by reference. Those ISO procedures are not final and are in the DIS (Draft International Standard) stage. ISO representatives have indicated that they will try to include the EPA/EMA agreed-upon changes prior to the finalization of the standard to facilitate harmonization. EPA should use this opportunity to work with industry and other regulatory agencies to ensure globally-aligned yet internally harmonized steady-state test procedures.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 65

CNH Global commented that although there can be valid reasons for different test cycles between on-road and non-road and between U.S. and EU, in the context of the proposed rule there are no justifiable reasons for having different emissions measurement, sampling and calibration procedures. The PM and gaseous emissions measurement methods and calibrations as well as partial flow tunnels for particulate measurement on the transient cycle, should be aligned between the U.S. and the EU. These and other issues such as NTE, all ambient condition tests, in-use testing and after-treatment regeneration factors are developed with EPA's participation and direction within the new non-road GRPE group, which has a clear mandate to develop such items under globally aligned regulations.

Letters:
CNH Global, OAR-2003-0012-0819 p. 9-10

Lister Petter commented that it supports EPA's proposal to adopt the test procedure improvements as specified in ISO 8178-1 and ISO DIS 8178-11 to achieve a universal test standard and thereby improve accuracy and alignment with European and Japanese emission standards.

Letters:
Lister Petter, OAR-2003-0012-0155 p. 1

Our Response:

We have tried to harmonize our nonroad CI test procedures with international test procedures, as well as our highway test procedures (see 9.5.5.3). However, as EMA pointed out in its comment above, the ISO procedures are not yet final. We proposed to adopt ISO standards for certain test procedures and some ISO standards are incorporated by reference, where appropriate. In addition, we have held regular test procedure meetings with industry to discuss how to include ISO procedures in the Part 1065 test procedures. We believe that Part 1065 should be the basis for any globally harmonized test procedure. Part 1065 builds on the sound procedures in Parts 86 and 89 and ISO; it also integrates field testing; it scales across a large range of engine categories and emissions standards; and it is based on SI.

It is also important to note that we allow for other test methods in 1065.10. Thus, even though some international procedures are not specifically included, they are not explicitly excluded for all cases. Manufacturers wishing to use these others procedures may ask for our approval to use them.

The comments described above by EMA and CNH are incorrect. The procedures mentioned are described in 40 CFR 86.1360-2007 and do not apply to nonroad.

We disagree with the CNH's comment that the NTE tests, ambient condition limits, in-use testing and after-treatment regeneration factors should be developed internationally. See 9.5.5.12 for more details.

9.5.5.3 The Test Procedures and Methods Between the On-highway and Nonroad Rules Should Be Harmonized

What Commenters Said:

EMA commented that although the test cycles could be different for on-highway and nonroad engines, the test procedures and methods should be common between the two. EPA should allow sufficient time for the development of Part 1065 where the common test procedures would be established, and should devote additional Agency resources towards this harmonization effort.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 64-65

Our Response:

We agree with the manufacturers' goal. In developing the procedures described in part 1065, we intended specify procedure that would allow manufacturers to use a single set of equipment for testing both highway and nonroad engines. We will continue to work with manufacturers and other interested parties to optimize the two procedures.

9.5.5.4 EPA Should Propose Changes to (and Evaluate the Capability of) Testing Measurement Procedures to Accommodate the New Standards, Transient Test, and NTE Requirements

What Commenters Said:

DDC and EMA commented that unless the measurement methods are substantially improved, it will not be possible for engine manufacturers to develop and certify engines at the levels proposed. The current federal test procedures and the associated measurement equipment (FTP) were never designed to provide reliable and accurate measurements at extremely low emission levels, and could result in a situation where the variability associated with lab measurements is 50 percent or more than the standard for Tier 4 engines. EMA noted that testing data from heavy-duty on-highway engines demonstrates this variability and refers EPA to the EMA Statement of the 2007 Rule, p. 33-35 for a detailed discussion of the measurement variability data. Manufacturers must be able to reliably resolve the impact of design changes that affect emissions on the order of 10 percent of the standard. An inability to measure the impact of design changes necessitates a large number of tests and increases the risk of incorrect decisions during the development process. In addition, a high variability precludes the establishment of deterioration factors without a large number of tests. Substantially improved test procedures and equipment must be developed, with sufficient lead time to allow manufacturers to upgrade their facilities, if the proposed standards are to be finalized and implemented.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 3
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 52

EMA commented that the measurement concerns pertaining to the FTP will be exacerbated by the proposed addition of the new transient tests and the NTE requirements, which essentially require manufacturers to make accurate measurements averaged over a period as short as 30 seconds, when current measurement capability is not adequate to accurately and reliably measure composite average emissions over the much longer steady-state and transient test cycles. Technologically feasible emission standards cannot be determined without accurate and reliable test procedures and measurement methods.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 52-53

Our Response:

We have incorporated into the nonroad test procedures the improvements made to the highway test procedures to increase accuracy and repeatability. We will continue to work with manufacturers to improve these test procedures. We have also made revisions to the DF requirements to address the low emission levels.

9.5.5.5 EPA Should Approve Nonroad Engine Testing Procedure for Steady-state Modes That Allows for the Continuous Measurement of Emissions

What Commenters Said:

EMA commented that EPA should approve testing procedures under which discrete steady-state test points are not run individually but run as a cycle with the engine transiting from one mode to the next within 20 seconds. Under this approach, the measurement of emissions is not discontinued between modes. A single filter collected over the pseudo-transient cycle would be the way to record PM measurements, but this is only appropriate where full dilution systems are required for the cycle measurements. The current steady-state tests are appropriate for constant speed engines and engines > 750 hp. This test can use partial dilution systems for measuring PM. Accordingly, the use of partial dilution systems with discrete measurements at a given speed and load must be allowed.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 64

Our Response:

We are adopting "ramped modal " versions of EPA's nonroad steady-state duty cycles in the Tier 4 final regulations as an alternative to testing using the 8-mode, 5-mode, 6-mode, marine and TRU cycles, in particular ; however, ramped modal cycles (RMCs) could be constructed for any of EPA's steady-state certification test cycles. The RMCs are quite similar to the test procedure urged in this comment, and EPA worked with the commenter in developing these optional test cycles. The cycles and the background on their development are described in detail in the Preamble, Chapter 3 (F)(4) Test Procedures, and in RIA Chapter 4.3.1 for this rulemaking.

9.5.5.6 EPA Should Use the Maximum Vector Speed with a 5 Percent Tolerance as the "Rated Speed" Used for the Steady-state Test Modes and the 100 Percent Speed for Purposes of De-normalizing the Transient Cycle

What Commenters Said:

DDC, EMA, and Euromot commented that EPA only allows for a +/- 2 percent tolerance in the context of the vector approach. However, an increased tolerance is necessary and appropriate for the following reasons: 1) the tolerance has little impact on emissions, 2) the tolerance will allow the manufacturer to set the power and speed at the nominal level and still have an adequate margin between rated speed and governor break speed (in order to avoid issues associated with governor instability and power variation), and 3) the tolerance will allow the vector approach to be consistent with the approach being considered by ISO. In addition, a 5 percent tolerance would allow a single certification test to satisfy both EPA and EU test procedures. DDC specifically noted that the maximum test speed should continue to be the manufacturer's rated speed.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 6
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 65
Euromot, OAR-2003-0012-0822, 0823 p. 10

EMA commented that EPA proposes to apply the existing definition of maximum test speed (in Part 1065) to nonroad CI engines, but this definition is no longer aligned with the rated speed definition that is currently used and will continue to be used by ISO.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 64

Our Response:

We are changing the existing definition of maximum test speed in part 1065 in this rulemaking. It will apply to Tier 4 nonroad CI engines along with all other part 1065 provisions. However, we will consider revisions to the application of the maximum test speed requirements in a separate rulemaking related to part 1065.

9.5.5.7 In Lieu of Engine Testing, EPA Should Consider Using the Rated Power as Specified by the Manufacturer to Define Maximum Engine Power

What Commenters Said:

DDC and EMA commented that even though there is no definitive method of how a nonroad engine manufacturer is to define power, the manufacturer-defined approach has proven to be superior to using test results. However, EPA could define maximum engine power using engine testing provided that: 1) the definition does not lead to testing inconsistencies between EPA, EU, and ISO test procedures, 2) the definition does not create confusion with customers, and 3) there is adequate tolerance included in the definition such that it can be a nominal value defined by the manufacturer rather than one that can only be determined through testing. EPA's definition needs to allow for reasonable production variation, an adequate margin for setting governor breakaway, and a modest power "bulge." Otherwise production variability could lead to different engines of the same rating being in different power categories. In addition, EPA's proposal requires that maximum power be the maximum that occurs anywhere on the torque curve, which is unlikely to occur at "rated speed." In order to address these concerns, EPA should adopt a requirement that the maximum engine power be the rated power as specified by the manufacturer, provided that the maximum engine power is within 10 percent of the highest power measured during the power-map of the engine that is used to de-normalize the transient test.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 6
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 65-66

CNH commented that there should be no doubt as to exactly what the power definition is when related to emissions measurement. They added that the ISO-14396 power standard is used (uncorrected) for emissions measurement, which is based on ISO-8178; and the ISO-14396 is used (corrected) for emissions decal declaration, establishing the different emissions power categories, sales and advertising literature, European Power Certification, and ABT Calculation. The ISO-14396 evolved in parallel with ISO-8178 and is customized for non-road engine emissions declaration. This power standard is now being converted into an ECE Regulation under the GRPE mandate for a globally aligned power definition. This will ensure that all manufacturers have a common power declaration. CNH noted that if future concerns arise regarding governor curve shapes on electronically controlled engines or on the power bulge, then limits should be set on the allowable variation from the manufacturers declaration and that any new revised proposals should go through the new GRPE World Forum for aligned regulations.

Letters:
CNH Global, OAR-2003-0012-0819 p. 9

EMA commented that if manufacturers determine that the specified maximum engine power is outside of the normal production range, we should allow the manufacturers to amend the application for certification or change the settings of the engines being produced.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0938

Our Response:

The definition of "maximum engine power" does not affect test procedures in any way. It is only relevant with respect to determining the power category in which an engine family belongs and to the calculation of ABT credits. Therefore, how we define it will not create testing inconsistencies.

We are not adopting EMA's recommendation because it would still allow manufacturers to arbitrarily determine how the standards apply within a 20 percent power window. We agree with manufacturers, however, that "maximum engine power" should not be specified solely by testing. Our goal is for the definition to not rely on manufacturer's discretion and to ensure that the resulting maximum engine power value be representative of production engines. Therefore, the definition being finalized specifies that the maximum engine power is the highest power level on the nominal power curve. (The nominal power curve is the manufacturer's best preproduction projection of the power/speed relationship of production engines for a given engine model.) The approach being finalized allows for reasonable production variability. It will also allow for "power bulges" during engine lugging because we specify that engines be mapped with increasing power rather than lugging power down. Thus, it is allowable for engines to have higher power on the lug curve than on increasing power map.

There is no reason that the final definition should cause confusion for customers, since we do not require that manufacturers inform the customers of the EPA-defined maximum engine power.

The CNH comment regarding ISO-14396 is not relevant to this issue, since it relates to the measurement of power, rather the regulatory definition of the maximum power.

We agree with EMA's comment that we should allow the manufacturer to amend the application for certification or change the settings of the engines being produced if it is determined that the specified maximum engine power is outside of the normal production range.

9.5.5.8 EPA Should Give Manufacturers the Option of Defining the Mode 1 Power to Be the Engine Power Specified on the Manufacturer's Data Sheet

What Commenters Said:

EMA commented that the emissions regulations for nonroad variable-speed engines call for Mode 1 as the maximum power at rated speed, which makes sense because these engines are typically matched to machines that can use this full power. However, engines used in constant-speed applications have very strict requirements on operating frequency, and serious damage can occur if the engine speed drops by more than a few percent. The actual amount of governing power available to the generator set will vary by engine manufacturer and may be above the engine power specified on the manufacturer's data sheet. Therefore, running Mode 1 of the steady-state D-2 cycle at the maximum fuel flow setting amounts to running the engine at a condition at which the engine cannot run under steady-state conditions.

Letters:

Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 67

Our Response:

Section 1065.10 allows us to modify test procedures to make them more representative of in-use operation. If the Mode 1 power cannot be run, we will allow manufacturers to test at a different power level.

9.5.5.9 The Proposed Test Methods Do Not Adequately Address NMHC Measurements, Particularly for Natural Gas and Diesel Fueled Engines

What Commenters Said:

EMA commented that natural gas fueled engines are expected to have large amounts of methane relative to total hydrocarbon (THC), so a method is needed to measure the NMHC. However, there could be significant variability associated with subtracting methane (CH4) from THC to calculate NMHC as the level of methane increases. The current or proposed changed to Part 1065 do not address NMHC for SI engines and better measurement methods are needed, especially for natural gas (NG). A direct measurement of NMHC using a NMHC analyzer would eliminate the error associated with subtracting two large numbers. It would be reasonable to combine current on-highway test procedures and allow for an unheated HC bag sample measurement, which would allow for a more accurate and direct measurement of NMHC. The commenter provided additional discussion regarding the potential challenges associated with this approach.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 69-70

EMA commented that for diesel fueled engines, an unheated HC bag sample is not likely to be appropriate for measuring the NMHC due to the presence of other heavy HC species. A heated NMHC bag sample would solve this problem, but it is not currently available, so methane would need to be measured separately on a dry basis. Drying the sample avoids costly requirements associated with dehumidifying the dilution air, diluting the methane bag sample, or keeping the sample above the dew point. EPA should allow for the flame ionization detector (FID) to be equipped with a methane cutter as a more cost effective method to measure the methane in the bag sample. Running two continuous FID (one for THC and one for methane using a non-methane cutter) should also be considered.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 70

Our Response:

We believe that the specified NMHC test procedure, which is the same procedure we finalized for heavy-duty on-highway diesel engines (66 Fed. Reg. 5001 January 18, 2001), is adequate for the Tier 4 program. The HDDE NMHC levels are similar to those proposed in this rule. The test procedure specifies the use of a gas chromatograph (GC) for determining CH4 via bag sampling and a heated flame ionization detector (HFID) for determining total hydrocarbons (THC) via a continuous sampling. This test procedure is already used successfully at the most stringent light-duty gasoline hydrocarbon standard, which is significantly lower than the NMHC standard proposed for this rule.

We believe that the fraction of CH4 in THC from non-road diesel engines is not an issue because light-duty THC emissions can be upwards of 90 % CH4, which is higher than what we expect from non-road diesel engines.

This procedure already allows for the use of an unheated bag for CH4 sampling, which can be dried as one commenter describes.

While we are not aware of any direct NMHC analyzer, we did propose to allow for the use of alternate systems according to 86.1307-2007 if such an analyzer was used to demonstrate equivalence. The same is true for the use of a non-methane cutter. We intend to propose additional changes to Part 1065 (Test Procedures) in an upcoming NPRM. In this future NPRM we will consider allowing the use of a non-methane cutter.

9.5.5.10 The Proposed Provisions Regarding the Generation and Use of Deterioration Factors (DF) Are Problematic and Unnecessary and Should Be Eliminated or Revised

What Commenters Said:

DDC and EMA commented that in some cases there is confusion about when additive and multiplicative DFs are to be used. The form of the DF for each pollutant depends on the use and type of aftertreatment. The DFs for PM, HC and CO would all be additive if a catalyzed PM filter were used, since this type of aftertreatment controls HC and CO along with PM. However, if an oxidation catalyst were used in conjunction with a catalyzed PM filter, it is unclear whether the CO and HC DFs would be additive or multiplicative.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 3
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 88

EMA commented that DFs are generally developed through service accumulation and testing, which is time consuming and costly. EPA only allows for the test results to be extrapolated to full useful life only after the testing has established an increasing trend in emissions results, which cannot be presumed since experience has shown that diesel engine emissions are frequently stable or decrease with age. Given the extremely low levels of the Tier 4 emission standards and the inherent variability in the measurement of these emissions, such testing programs will often result in DFs that are not realistic or representative of the true emission deterioration, which is exacerbated when the test results are extrapolated to full useful life and/or when multiplicative DFs are used.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 88

EMA commented that testing variability can cause the emissions at the high-hour test point to be higher or lower than at the low-hour test point even if there is no real "deterioration." This variability can be 10 percent or more of the Tier 4 standards and if the test results are extrapolated, the test variability component of the DF can account for a large part of the standard. The alternatives that could reduce this variability (such as using less extrapolation and running service accumulation closer to the full use life or running more emission tests at each service accumulation test interval), are costly and time-consuming.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 89

EMA commented that the combination of test variability, near-zero measured emissions, and multiplicative DFs is problematic, since as the low-hour emission test results approach zero (as is the case for PM, HC and CO emissions on a PM filter equipped engine), the resulting multiplicative DFs become very unstable. Very large DFs can be generated due to even small amounts of test variability between the low-hour and high-hour test points and high degrees of extrapolation exacerbate this problem.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 89

EMA commented that the use of multiplicative DF in cases where measured emissions are zero or negative creates mathematical anomalies. For example, if the measured emissions at the low-hour point are zero, the divide-by-zero situation and the multiplicative DF will be indeterminate, and if the low-hour measured emissions are negative and the high-hour emissions are positive, the result will be a negative DF. In addition, if the measured low-hour emissions are negative and the measured high-hour emissions are more negative, the DF will be a positive value greater than one.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 89

Lastly, EMA stated that since EPA has announced its intent to promulgate an in-use manufacturer-run testing program for nonroad engines, the need for DFs is greatly reduced if not eliminated entirely. The DF requirements should be removed from the proposal. If DF provisions are to be included, the requirements to use multiplicative DFs must be eliminated and EPA should work with EMA to develop a workable approach for DFs.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 89

Our Response:

We continue to believe that DFs based on engine testing are an essential part of our overall compliance program. It is not sufficient to rely on an in-use testing program that would not catch durability problems before the excess emissions occur. It is clearly preferable to have manufacturers demonstrate before production that their emission controls will be durable. Nevertheless, we agree that this burden should be minimized to the extent possible. Therefore, as described in §1039.245, we allow extensive use of "carryover" information from other engine families. We also allow the use of engineering analysis, instead of engine testing, in many other cases.

With respect to the arithmetic nature of the DF, we agree with manufacturers that additive DF are generally appropriate, and have modified the regulations accordingly.

9.5.5.11EPA Should Modify the Proposed Criteria for Test Engine Selection at Section 1039.235(b) to Be More Specific

What Commenters Said:

EMA commented that the term "highest fueling rate" should specify "highest volume of fuel injected per combustion cycle." EMA also commented that the engine selection criteria for test engine selection, such as "good engineering judgment" confuses the definition and opens the door for unproductive and subjective controversy.

DDC commented that the highest fueling rate per combustion cycle should be the sole criterion for determining the parent engine for an engine family.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 91
DDC, OAR-2003-0012-0783 p. 8

Our Response:

We agree that the regulations should state "highest volume of fuel injected per combustion cycle" instead of "highest fueling rate" when specifying the default test engine. However, we disagree that this should be the only criteria. The purpose of certification is to show that all of the engines in an engine family comply with the standards. Under EMA's approach, if a manufacturer knew that the engine with highest volume of fuel injected per combustion cycle was not the highest emitter, it would still claim to show compliance using emission data that was lower than some other engines in the family. This is not appropriate. In order to show that all engines in the family comply, the manufacturer should submit the highest emission rates. However, the proposed regulations do not require that manufacturers go to great lengths to find the highest emitter. Rather, they specify that manufacturers should not test the default engine if "good engineering judgment indicates that a different configuration is more likely to exceed (or has emissions nearer to) an applicable emission standard." Manufacturers provided no rationale for why they should be allowed to test an engine for certification that they know is not the worst case.

It is worth clarifying, though, that we expect that it will be appropriate for manufacturers to test the default engine in most cases. Based on our current understanding of the emissions performance of diesel engines, we expect that engines highest volume of fuel injected per combustion cycle will generally have the highest emissions. Moreover, since engine families are supposed to be groups of engine with similar emissions, there should not be large differences in brake-specific emission rates in most cases. Nevertheless, it is possible that advanced emission controls may respond differently, and that in some cases it may become clear that the engine highest volume of fuel injected per combustion cycle is not the worst case engine.

9.5.5.12 EPA Should Participate Actively in the GRPE Off-Cycle Working Group, and Should Align Their Regulations with the Resulting Recommendations

What Commenters Said:

DDC and EMA commented that EPA seeks to clarify that both the transient test cycle and the NTE "test procedures" are included within the defeat device regulations under which an operational AECD will not be considered a defeat device. EPA also proposes to require more detailed information regarding any AECDs necessary to protect the engine or equipment from damage or accident (see proposed section 89.115(d)(2)). With respect to AECDs, EPA should participate in the GRPE Off-Cycle Working Group, which will provide greater certainty and harmonization with respect to these issues.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 8
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 101

CEMA-CECE commented that the efforts of the working group on nonroad mobile machinery (NRMM) set up by GRPE within the UN-ECE, which entail the development of a global technical regulation, is an indispensable preliminary activity for achieving alignment of applicable test procedures.

Letters:
CEMA-CECE, OAR-2003-0012-0598 p. 5

Our Response:

We recognize that the GRPE process represents an opportunity for global harmonization. However, the timetable for addressing the specific concern of the commenter is not consistent with the timing for finalizing this rulemaking. The Agency remains confident that the NTE procedures, as finalized, remain a valuable tool for potential incorporation into Global Technical Regulation. Once the process for including the Agency's thinking on NTE reaches a point for potential adoption or consideration in GRPE, the Agency remains ready to provide technical details for moving the process forward.

9.6 NTE Requirements

9.6.1 Commenters Support the Proposed NTE Requirements

What Commenters Said:

CARB, NESCAUM, NRDC, and the New York Department of Environmental Conservation commented that they support the proposed NTE requirements.

Letters:
New York Public Hearing
A-2001-28, IV-D-05 [NESCAUM p. 99; NRDC p. 31; NY DEC p. 12]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [CARB p. 19]

Our Response:

We agree that NTE provisions are an important part of our compliance program. We are requiring compliance with the NTE in the first year that aftertreatment-based standards take effect (see preamble Table III.J-1). However, we are not requiring compliance with the NTE for under 25 hp engines until 2013, and not requiring compliance with the NTE for the interim PM standard for 25-75 hp engines. The reason is that we believe engine makers' finite resources are better directed toward compliance with the stringent aftertreatment-based standards rather than being diverted excessively to developing NTE strategies for the interim PM standard or the PM standards for the smallest engines.

9.6.2 Commenter Conditionally Supports the Proposed NTE Requirements

What Commenters Said:

Yanmar commented that the proposed NTE requirements may be acceptable provided that they are not too burdensome on the manufacturing industry. If adopted, Yanmar believes, the NTE requirements should only apply to engines with full electronic management systems. These requirements should not apply to mechanically controlled engines, since the emission characteristics for these engines are not controlled freely.

Letters:
Yanmar, OAR-2003-0012-0615, 0813 p. 7

Our Response:

We disagree that the NTE should only apply to electronically controlled engines. As described in the RIA, we have determined that the NTE standards are feasible for all nonroad CI engines.

9.6.3 Commenter Supports the Alternative NTE Methodology

What Commenters Said:

CARB commented that EPA should adopt the alternative NTE methodology rather than the primary methodology. Even though both strategies would be useful for evaluating in-use compliance, the alternative approach has the potential to be more robust for nonroad applications. The alternative proposal uses "work performed" instead of "running time" as the basis for determining whether or not emissions have exceeded the NTE standard. Among other benefits, this would enable emissions performance to be evaluated during nearly all ranges of engine operation rather than only those ranges encountered within limited NTE zones. In addition, full range NTE operation would eliminate the need to measure real-time torque and would allow exhaust flow to be inferred rather than measured, which will simplify OBD. The alternative NTE procedure would provide many more opportunities on average for determining emissions compliance in the field.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 9

9.6.4 Commenters Conditionally Support the Alternative NTE Methodology

What Commenters Said:

CARB, STAPPA/ALAPCO., and UCS commented that the alternative NTE approach would be an acceptable alternative to the proposed NTE requirements, provided that the work interval truly reflects typical actual operation in use. The alternative NTE methodology can be used to evaluate compliance for nearly all ranges of engine operations, rather than just those conditions encountered within a predefined operating zone. However, adoption of the NTE standards should not be delayed to allow for the implementation of this alternative approach, since any delay in NTE will make the Tier 4 standards less enforceable.

Letters:
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 17
Union of Concerned Scientists, OAR-2003-0012-0830 p. 9
New York Public Hearing, A-2001-28, IV-D-05 [CARB p. 143]

9.6.5 EPA Should Not Finalize the Alternate NTE and Should Instead, Carry over the Recently Clarified On-highway NTE Requirements as Modified for Nonroad Engines

What Commenters Said:

DDC and EMA commented that EPA has failed to provide adequate notice relating to the alternate NTE. The preamble discussion that set out and requests comment on the alternate NTE is very brief and simply refers the reader to Section 4.3 of the RIA, which includes a longer discussion but does not provide any specifics or actual test data regarding how an engine manufacturer would run a certification test to ensure compliance with the alternate NTE, how the alternate NTE compares in terms of relative stringency with the on-highway NTE requirements, or how EPA assessed and proved the technical feasibility of the alternate NTE. In addition, EPA's supplements to the docket do not address these issues.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 6
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 40-41, 112

Cummins, DDC, EMA, and Euromot commented that the alternate NTE is inherently more stringent than the on-highway-based NTE. This is inconsistent with the basic premise of the Tier 4 rule that nonroad engine technologies are derivative from on-highway technologies and that emission control requirements need to be proven in the on-highway sector before being applied to nonroad engines. It is also inconsistent with Sections 213(a) and (d) of the CAA (i.e. in promulgating standards for nonroad engines, EPA "shall first consider standards equivalent in stringency" to the on-highway standards). The alternate NTE would apply to all nonroad engine operations, including extended idle and low power operations, which are inherently high in terms of work-based emissions. The on-highway NTE Zone excludes such operations. Including low speed-load and idle operations in the alternate NTE essentially requires nonroad engine emissions resulting from operation falling within this zone to be lower than on-highway engines and the use of longer NTE averaging times do not resolve this issue. In addition, since the alternate NTE calculation method would use an engine family's average brake-specific fuel consumption (BSFC), nonroad engine NTE emissions will be higher in operating modes where actual BSFC is lower than the average BSFC. The commenters provided significant additional discussion on this issue, including a detailed description of the on-highway NTE requirements and how they compare to the alternate NTE.

Letters:
Cummins, Inc., OAR-2003-0012-0650 p. 6-7
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 6
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 41-43, 112
Euromot, OAR-2003-0012-0822, 0823 p. 9

DDC, EMA, and Euromot commented that EPA has not established the technical feasibility of the alternate NTE. Even though the RIA presents the emissions test data in support of the alternate NTE, EPA has not provided any actual emissions data. Instead, EPA describes the process of optimizing the alternate NTE so that it would achieve a level of compliance similar to the on-highway NTE requirements. EPA uses a reverse engineering (or trial and error) process by predetermining that the on-highway NTE multiples (1.25 and 1.5) should be retained and then assessing longer or shorter averaging periods to see which period over which length of emissions data would yield results most closely aligned with the on-highway NTE methodology. The alternate NTE was established through a seemingly rudimentary trial-and-error method to align results using just a few data sets, none of which involved a Tier 2 or 3 nonroad engine, a Tier 4 prototype, or a engine equipped with any type of emissions aftertreatment system. Instead, EPA used a "NO_x adsorber model" as a substitute for an actual prototype Tier 4 engine. In addition, the limited data sets were derived from the operation of only two bulldozers, one excavator and one haul truck, which represent only four out of the literally thousands of nonroad engine applications and duty cycles. This limited data should not be used to form the basis of a new emission standard and cannot establish the feasibility of the alternate NTE.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 6
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 43-44, 112
Euromot, OAR-2003-0012-0822, 0823 p. 9

DDC and EMA commented that there is no proper test method for the alternate NTE. EPA's description of the procedure for compliance testing in the RIA is more conspicuous for what it does not specify than for what it does. For example, EPA does not provide a specification regarding what type of engine test data should be "merged" to make up a minimum 6-hour data set. There are a number of additional questions that need to be answered in this context, regarding the duty cycle, emission data (steady state, in-zone, etc.), uniformity of "merging" practices, and other related issues. The number of unanswered questions illustrates that there is no real test procedure for the alternate NTE and thus, no way for manufacturers to assure that its engines are in compliance.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 6
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 44-45, 112

Caterpillar and NRDC commented that there is an urgent need for an effective NTE program as soon as possible and the basic highway approach is a workable option for the nonroad program. The alternate NTE will not address the disconnect between certification and real world emissions. The work interval may not accurately reflect the typical actual operation of the engine or equipment. One commenter (Caterpillar) added that having different protocols in both the highway and nonroad segments will not allow for test techniques to be transferred and would make engine development more difficult thus disallowing the effective transfer of technology from the on-highway sector to the nonroad sector. EPA should work with industry to develop the details for the final NTE test protocol since the on-highway NTE may need some adjustments to allow for its application to the nonroad sector.

Letters:
Caterpillar, Inc., OAR-2003-0012-0812 p. 1-2
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 32

Euromot commented that the alternative approach would require in-use testing or running the engine through specific NTE cycles before being able to make a compliance state. This is not acceptable to engine manufacturers, since there is a high risk of non-compliance in cases where the in-use operation of a specific machine is different from the testing NTE cycle.

Letters:
Euromot, OAR-2003-0012-0822, 0823 p. 9

Our Response (for 9.6.3 - 9.6.5):

We are finalizing NTE based on the highway approach and are not adopting the alternative NTE approach. We believe that this is appropriate given the degree to which nonroad CI engines are derived from highway engines. Nevertheless, we believe that the alternative approach has some advantages and we may reconsider it in the future (with appropriate notice and opportunity for comment).

9.6.6 EPA Should Not Include NTE Requirements in the Proposed Rule

What Commenters Said:

ARA commented that engine and equipment manufacturers should be given time to evaluate the potential impact on equipment performance of various nonroad packages. A more appropriate time to establish the NTE standards is when EPA proposes rules covering OBD and in-use testing. EPA should work with industry representatives to ensure that the standards do not compromise engine performance.

Letters:
American Rental Association, OAR-2003-0012-0612 p. 4

Our Response:

We disagree with this comment. We have determined the NTE standards to be technologically feasible. The NTE requirements supplement the other nonroad standards and test requirements and should be considered together with them. The NTE is, in fact, a critical element of assuring that the standards result in the greatest achievable emission reduction when these engines are in actual operation

9.6.7 EPA should modify the proposed NTE deficiency provisions

What Commenters Said:

DDC and EMA commented that EPA proposes that the NTE deficiency provisions become available when the Tier 4 interim standards take effect, but with stringent limitations on the number of deficiencies. However, the need for deficiencies will be increasing at the same time that the number of allowed deficiencies is reduced. EPA should allow for unlimited deficiencies during the first two years of the interim and fully phased-in Tier 4 standards for each power category, and the allowable number of deficiencies should be reduced to three during the remaining years that the interim and final Tier 4 standards are in effect. In addition, the 7-year limit on the use of deficiencies should be eliminated since EPA retains the authority to grant or refuse deficiency requests.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 6
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 46, 112

DDC and EMA also commented that EPA should remove the provisions that approves deficiencies on an engine model/power rating basis, or should clarify that if the same deficiency type is used on several power ratings in an engine family, this would be counted as one deficiency. Otherwise, manufacturers will be forced to limit family size to no more than three power ratings.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 6
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 46, 112

STAPPA/ALAPCO and UCS commented that the NTE deficiency provisions would allow EPA to accept a nonroad diesel engine as compliant with the NTE standards even though some specific requirements are not fully met. There is a need for flexibility, but EPA should limit these flexibility provisions to no more than three model years. One commenter (STAPPA) added that EPA should clarify in the final rule that an application for a deficiency for failure to meet the FTP or transient standard will not be considered.

Letters:
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 16-17
Union of Concerned Scientists, OAR-2003-0012-0830 p. 9

CARB commented that EPA should clarify exactly what constitutes an allowable deficiency before proceeding with the allowance. Deficiencies should be defined, at least in part, as bounded sub-regions of the NTE zone where, under normal engine operation, NTE evaluations are unreliable due to a high incidence of false failures or where the NTE evaluation fails to detect emission in exceedance of the NTE standard. Sub-regions should not overlap or constitute more than five percent of the total NTE zone. This would allow 20 or more sub-regions where deficiencies can be applied, which is necessary to prevent abuse of the provision where several deficiencies might mean exemption from the entire NTE requirement.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 9

CARB commented that allowing for an unlimited number of deficiencies for the first three years after NTE is introduced, opens the door for abuse which could effectively give manufacturers a three year reprieve from having to comply with the requirements. EPA should either reduce the number of deficiencies during this period to ten, which would ensure at least 50 percent NTE capability, or should set a higher NTE threshold for the introductory years without a deficiency allowance.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 9

Lastly, CARB stated that allowing three deficiencies through the seventh model year of production will not be a useful tool for enforcing compliance with the standards until the 2018-2020 timeframes depending on the hp category. EPA should require fully compliant NTE systems by 2015 at the latest.

Letters:
California Air Resources Board, OAR-2003-0012-0644 p. 9-10

Our Response:

We generally disagree with the comments suggesting that we fundamentally change the deficiency provisions. The proposed provisions were based directly on the highway provisions. We are finalizing the proposed provisions with only minor changes.

The deficiencies will be allowed for a limited time because we anticipate manufacturers will need them as they introduce the new technologies. The commenters provided no information that showed that they will not be needed. We do not believe that we could at this time limit the nature of what constitutes a deficiency. By their very nature, deficiencies are artifacts of the design process and cannot be anticipated in a specific manner. It is important to note that all deficiencies will be subject to EPA approval.

We disagree with manufacturers that the deficiencies should be unlimited. We believe that the limits, which are consistent with the highway program, provide an important incentive for manufacturers to optimize their designs as soon as possible. We do agree with the manufacturers, however, that the regulations should clarify that we will not count as separate deficiencies those that are the same type, as long as they apply similarly to different power ratings within a family.

9.6.8 EPA Should Clarify the NTE Implementation Schedule

What Commenters Said:

Comparing the preamble with the regulatory provisions shows some discrepancies regarding the implementation of the proposed NTE requirements. For (1) engines in the < 19 kW power category, (2) engines in the 19 to 37 kW power category, and (3) engines in the 37 to 56 kW power category that are using the 2008 transitional PM standard, the preamble indicates that the NTE requirement begins in 2013, while the regulatory provisions indicate an implementation date of 2008. In addition, for engines in the power categories above 130 kW, the preamble indicates that the NTE requirement begins in 2011 (while the Tier 3 standards are still in effect and one year before the interim Tier 4 standards take effect). EMA also recommended that EPA clarify the schedule and follow the precedent set by the NTE requirement for marine engines, which apply two to three years after the base emission standards take effect.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 46-48, 112
DDC, OAR-2003-0012-0783 p. 6

Our Response:

EPA has clarified the NTE implementation schedule in the final regulations, and tried to assure that the preamble description is in accord with the regulatory text.

9.6.9 EPA Should Adjust the NTE Multiplier Threshold

What Commenters Said:

DDC and EMA commented that he nonroad NTE multiplier values of 1.25 and 1.5 are essentially identical to the on-highway values. Similarly, the numerical values of the NO_x and NO_x + NMHC thresholds used for determining which multiplier to use are also identical to the on-highway requirements. However, when these threshold values are considered in relation to the levels of the applicable standards, the proposed NTE multiplier threshold functions in a way that is more stringent for nonroad engines. Even though a similar percentage emission reduction is required for nonroad engines in 2011, the numerical emission standards are somewhat different. The proposed NTE multiplier thresholds need to be adjusted to achieve parity between the nonroad and on-highway categories. The threshold for the nonroad multiplier actually should be set 25 percent above the standard of 2.0 g/kW-hr, rather than at the identical on-highway levels. The result is that 130 to 560 kW nonroad engines certified to a NO_x standard or FEL less than 2.5 g/kW-hr should be able to use the 1.5 multiplier. This same approach should be used for each power category with a split-family standard, including the PM standard for engines greater than 560 kW.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 6
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 48-49, 112

Our Response:

We agree that the NOx threshold should be changed to 2.5 g/kW-hr. See section III.J of the preamble for discussion of this change.

9.6.10 EPA Should Add Special Provisions to Describe the NTE Zone Applicable to Constant Speed Engines

What Commenters Said:

DDC and EMA commented that in the proposed regulatory language at section 1039.515, the NTE "procedures" described for on-highway engines at 86.1370-2007 are made applicable to nonroad engines and are to be used to determine whether the NTE standards in section 1039.101(c) are met. However, the NTE zone described in 86.1370-2007 is intended to apply to variable speed engines and cannot logically be applied to constant speed engines. The NTE zone applicable to constant speed engines should be limited to a small speed range (+/- 1 percent) around the nominal constant operating speed since these engines are typically used for electrical power generation and operate only in a very narrow speed range.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 6
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 49, 112

Our Response:

We are not revising the NTE regulations for constant speed engines. We believe that the provisions allowing manufacturers to ask to exclude operation outside of the normal operation are sufficient to address manufacturer concerns. Section 86.1370(b)(6)(i) states, "the manufacturer may identify particular engine . . . combinations and may petition the Administrator at certification to exclude operating points from the Not- to-Exceed Control Area . . . if the manufacturer can demonstrate that the engine is not capable of operating at such points".

9.6.11 EPA Should Add Provisions That Would Exempt Engines During Start-up or Engines with Exhaust Emission Control Devices from the NTE Requirements

What Commenters Said:

DDC and EMA commented that even though the preamble discussion (68 FR 28368) reflects the intent of exempting EGR engines from NTE requirements during cold operating conditions by referencing paragraph 86.1370-2007(f), the proposed regulatory language does not contain any provisions that would allow for this exemption. EPA should correct this oversight.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 6
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 49-50, 112

Our Response:

Section 1039.101(e)(6) also provides specifically that NTE standards do not apply during cold operating conditions specified in 40 CFR 86.1370-2007(f) for engines equipped with EGR

9.6.12 EPA Should Clarify the Procedures That Are Used to Determine Conformance with the NTE Provisions

What Commenters Said:

EMA commented that it is assumed that the same procedures used to determine conformance with the standards given at section 1039.101(c) should also be used to determine conformance with the NTE standards given at section 1039.102(d)(1). The regulatory language at 1039.515 should be modified to reflect this.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 50, 112

Our Response:

Section 1039.102(g)(1) clearly references the provisions of §1039.101(e), which apply in their entirety with respect to the procedures used to determine conformance with the standards.

9.7 Certification Fuel

9.7.1 The Emission Test Fuel Specifications Applicable to Nonroad, Locomotive and Marine Engines Should Be Limited to No More than 500 ppm Sulfur Content

What Commenters Said:

DDC and EMA commented that he test fuel specification applicable to all 2007 and later model engines should be no more than 500 ppm, since maximum sulfur content of certification test fuel should be no greater than that specified by EPA for commercial use. In addition, the emission test fuel specifications for engines certifying to Tier 2 or 3 standards should allow for the use of a test fuel with a maximum sulfur content of 500 ppm (even in the absence of sulfur-sensitive aftertreatment), since the phase-in of the Tier 3 nonroad standards begins in 2006 and the Tier 2 locomotive and marine standards take effect in 2005 and 2004, respectively. These engines will operate on fuel with a sulfur level of no more than 500 ppm. This specification should also apply to engines that do not use a sulfur-sensitive aftertreatment if the engine manufacturer agrees to provide engine labels and owner's manual notices indicating that fuel with a sulfur content below 500 ppm is recommended. In addition, locomotives remanufactured and newly certified to Tier 0 standards in 2005 or later years should be certified on fuel with 500 ppm maximum sulfur, which would allow manufacturers to use one certification test fuel.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 4
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 91-92

Our Response:

We are adopting provisions in the final rule to allow testing with 500 ppm maximum sulfur test fuel in model years before 2008. See section III.D of the preamble. Adopting this test fuel specification for all testing in model year 2007 would be inappropriate as this fuel will not be generally distributed until well into the 2007 calendar year. We will address the issue of locomotive and marine certification fuel in a separate rulemaking that also addresses emission standards.

9.7.2 EPA Should Allow for the Use of Low Sulfur Certification Fuel Prior to 2007 MY for On-highway Engines and Vehicles That Employ Sulfur Sensitive Technology

What Commenters Said:

Isuzu commented that as EPA has acknowledged, the use of low sulfur fuel would encourage the introduction of low emission diesel technologies. The benefits of these technologies would be even greater in the on-highway sector, where diesel engines and vehicles are used in high volumes.

Letters:
Isuzu, OAR-2003-0012-0809 p. 1

Our Response:

We are not changing the highway engine certification requirements in this rulemaking. We may consider this issue in a future rulemaking upon showing that there is a practical need to do so.

9.7.3 EPA Should Ensure That Certification Fuel Is Representative of In-use Fuel

What Commenters Said:

The New York Department of Environmental Conservation commented that fuels used in certification and compliance testing must be representative of typical in-use fuels to ensure that anticipated emissions reductions will be achieved. Engines should not be certified on 15 ppm sulfur diesel fuel starting in MY2008, since this is at least 2 years before it can be assured that comparable fuel will be used in the field (except in cases of early introduction of aftertreatment equipped engines that must use ULSD). This engine certification loophole is unlikely to increase total refinery production of 15 ppm sulfur diesel fuel. In addition, at the national level it makes no difference whether the ULSD production above the levels consumed by MY2007 (and later) highway diesel engines is consumed by existing engines.

Letters:
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 4

The New York Department of Environmental Conservation commented that unless EPA proposes to adopt a low aromatics content requirement, the minimum aromatics content for certification fuel must be increased to a value closer to the norm for No.2 diesel fuel. There are some NOx and PM benefits to a very low diesel fuel aromatics level, but the 10 volume percent aromatics content minimum is too low. EPA should establish this level at approximately 20 volume percent.

Letters:

New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 4

CNH Global commented that the reference fuel for emissions tests needs to be the same for the U.S. and the EU. This includes increasing the US cetane number.

Letters:
CNH Global, OAR-2003-0012-0819 p. 9-10

Our Response:

We believe that our certification fuels will be sufficiently representative of fuels being used in the field. It would not be appropriate to base our standards on international test fuels that are not representative of U.S. fuels. However, §1065.10(c)(2) would allow the use of test data based on international fuel specifications, provided the data are equivalent to data using the EPA test fuel. Testing on 15 ppm maximum sulfur test fuel before model year 2011 is only allowed in special cases for which little environmental impact or a net environmental gain is expected due to the early introduction of clean engines.

We believe that 10 percent will represent the approximate minimum value of aromatics content of ultra low sulur fuels in the future. We also believe that advanced low-NOx engines will not be significantly affected by the aromatic content of test fuel.

9.8 General Compliance Provisions

Except as noted, all the comments addressed in this section were from the Engine Manufacturers Association (OAR-2003-0012-0656, 0657; p. 101 - 106).

9.8.1 Stationary and Competition Engine Requirements

What Commenters Said:

It is unreasonable to comply with the new requirements for stationary or competition engines in §§1068.310 and 1068.320 in the same time frame that manufacturers are developing engines that meet Tier 4 emission standards.

Our Response:

We proposed a new requirement to add engine labels to imported engines that are not subject to standards because they are stationary or used solely for competition. In the final rule we are including the proposed requirement and extending it to domestically produced engines. Manufacturers have reported that they are already doing this with their engines today. Also, we have adopted this same labeling requirement for all such spark-ignition engines in a previous rulemaking (67 FR 68242, November 8, 2002). While we generally do not impose requirements for these excluded engines under a program for nonroad engines, we believe it is necessary to require labels as a condition of the exclusion. This is especially important considering that loose engines are often shipped for eventual installation in an excluded application. Until the engine is installed in an application that is clearly excluded, it could easily be diverted for use in an application that is in fact subject to nonroad emission standards. To allow adequate time for all companies, we are allowing until January 1, 2006 to meet the labeling requirements.

9.8.2 Definition of "Good Engineering Judgement"

What Commenters Said:

The proposed §1068.5 does not define good engineering judgment, which leads to subjective rather than objective analysis. This section should either be eliminated or should be made inapplicable to nonroad diesel engines. Manufacturers need to have a clear indication of what the standards for comparison and judgment will be. EMA also noted that in Section 1068(e), the reference to Subpart F should be Subpart G.

Our Response:

We understand EMA's concern about the use of good engineering judgment. However, we believe it is necessary to rely on the use of good engineering judgment in many cases. In developing these regulations, we sought to balance the sometimes competing goals of maximizing manufacturer flexibility, minimizing testing and administrative burdens, ensuring good in-use control of emissions, and anticipating how new technologies will fit into the regulations. To the extent that we could, we drafted the regulations with specific provisions to accomplish these goals. Nevertheless, in some cases it is not possible to explicitly define how to handle every possible scenario, without relying on the application of good engineering judgment.

Consider as an example the issue of how to select the test engine. In order to ensure good in-use control, we need to have confidence in the manufacturer's demonstration during certification that all engines in the family comply with the applicable standards. Thus, the manufacturer should submit the emission test data for the highest emitting. However, if we required this explicitly, then the manufacturing would have the burdensome task of testing each engine to make sure that its test data represented the worst case. We could specify how to select a single test engine based on objective criteria developed from our current understanding of emission controls, but advanced emission controls may respond differently. Therefore, the regulations rely to some degree on the manufacturer using good engineering judgment to select the appropriate test engine.

Past experience in other source categories, such as light-duty vehicles, indicates that manufacturers and EPA generally share a common understanding of what represents good engineering judgment. Simply speaking good engineering judgment is the application of the principles of science and engineering to a set of facts. To the extent that there are disagreements, we will generally only require prospective changes. As specified in §1068.5(c)(1), we will not suspend, revoke, or void a certificate of conformity, unless we determine that a manufacturer deliberately used incorrect information, overlooked important information, did not decide in good faith, or made a decision that was not rational.

We have corrected the reference to Subpart G.

9.8.3 Confidentiality

9.8.3.1 Confidentiality Provisions

What Commenters Said:

Section 1068.10 should be replaced with the existing, more detailed confidentiality provisions contained in 89.7, which provide greater detail to nonroad engine manufacturers.

Our Response:

After reviewing §§1068.10 and 89.7, we concluded that the new section is equivalent to the old section. We communicated this to the manufacturers and heard no objection.

9.8.3.2 Confidential Business Information

What Commenters Said:

Any confidential business information that is gathered by EPA under Sections 1068.20 (entering facilities), 1068.27 (testing using production engines), 1068.110 (engines in service), 1068.201 (exemption request), 1068.401 (selective enforcement audits), 1068.501 (engine defects), or 1068.601 (hearing provisions), should be subject to the provisions of Section 1068.10, as revised according to EMA's recommendation.

Our Response:

We believe the proposed provisions in §1068.10 do not limit manufacturer's ability to claim information obtained from any of the referenced sources as confidential. To make this clearer, we are adding an explanatory note to the equivalent provisions in §1039.810, which apply specifically to nonroad diesel engines. We intend to propose this same language for §1068.10 in the future. We are not finalizing this new language in §1068.10 at this time, because other affected manufacturers have not had opportunity to comment on this.

In proposed section 1068.20 EPA should include a provision which requires the Agency to give 24 hours prior written or oral notification. If EPA's notification is less than 24 hours, EPA's ability to enter the facility should be subject to approval of a manufacturer's representative. This approach would be consistent with the current nonroad regulation at Section 89.129(g).

Our Response:

The existing reference in §89.129(g) says that short-notice EPA inspections must be approved in writing by EPA's Assistant Administrator for Enforcement, not engine manufacturers. Rather than prescribing our internal practices by regulation, we believe it is appropriate to continue to pursue this policy by way of internal policy guidance. We are therefore not changing the regulations to address this concern.

9.8.4 Audit Requirements

What Commenters Said:

Section 1068.27 is a new section which requires manufacturers, at EPA's request, to make a reasonable number of production engines available for a reasonable time to test or inspect them for compliance. However, Part 1068 already allows for SEA testing and section 1039.401 imposes an in-use testing requirement, so this section imposes additional audit requirements on a manufacturer that are redundant and unnecessary.

Our Response:

This provides another tool for EPA oversight of manufacturers' compliance and is nearly identical to the existing provision in §89.125.

9.8.5 Identical Terms

What Commenters Said:

With respect to section 1068.30, identical terms in sections 1068 and 1039 should be defined in the same manner (e.g. engine manufacturer, ultimate purchaser, United States).

Our Response:

To the extent possible, we have used the same definitions in part 1039, 1065, and 1068; however, there are cases in which we cannot use the same definitions in all parts. For example, in part 1068 we define "engine manufacturer" to mean the manufacturer that is subject to the certification requirements of the standard-setting part. This definition includes equipment manufacturers for equipment regulated under equipment-based standards. On the other hand, in part 1039, the term needs to distinguish the manufacturer of the engine from the manufacturer of the equipment because they are subject to different requirements. We agree, however, that the definitions of "ultimate purchaser" and "United States" should be the same.

9.8.6 Exemption Provisions

9.8.6.1 General

What Commenters Said:

The exemption provisions under Section 1068.201(d) are redundant and unnecessary. This requirement contains language which differs from the current regulatory requirement in Part 89. This requirement should be eliminated because specific exemption provisions in 1068 already contain similar language which imposes these additional requirements on manufacturers.

Our Response:

Clean Air Act section 208 clearly authorizes the type of information collection specified in §1068.201(d) to adequately oversee our exemption provisions, so we are keeping the language as proposed.

9.8.6.2 Display Exemptions

EPA should retain the language in section 89.907 regarding display exemptions. Section 1068.220(a) would require manufacturers to request a display exemption from EPA. Engine manufacturers should not have to request a display exemption from EPA. Such an exemption should be granted automatically, and the engine will contain an appropriate label showing it is a display engine. Also, Section 1068.220(c) requires prior approval from EPA if the display engine is to operate while on display. However, the existing section 89.907 indicates that "...operation incident and necessary to the display purpose..." is allowed.

Our Response:

We agree that manufacturers should not need to request our approval to produce or import display engines. However, we believe it is appropriate for these engines to be handled under the separate provisions of the manufacturer-owned exemption, which involve minimal administrative requirements. The display exemption is intended for other commercial interests, for which we believe the proposed restrictions are appropriate.

9.8.6.3 Competition Exemptions

What Commenters Said:

Section 1068.235(c) would impose a requirement on the owner of an engine that is exempt due to its use in competition, to advise a new owner in writing that the engine is to be used solely for competition. This is unnecessary since Section 1039.620(f) already requires that an engine used solely for competition must be permanently labeled.

Our Response:

The provision in §1068.235(c) exempts individuals from the tampering prohibition if they modify a certified engine to be used solely for competition. These engines have no permanent label identifying them as competition products. The corresponding requirement engines in §1068.235(a) addresses new engines produced by the manufacturer under a competition exemption. We have modified the regulatory language to clarify these distinctions.

9.8.6.4 Replacement Engines

What Commenters Said:

Section 1068.240(b)(3) allows a replacement engine to be used only if "no engine certified to the current emission requirements is available with the appropriate physical or performance characteristics for the piece of equipment." This is burdensome and contradicts the approach that EPA has allowed with respect to nonroad CI engines for many years. Under Part 89 (see section 89.1003(b)(7)(i)), a nonroad engine manufacturer is required only to determine that no engine built by itself, or by the manufacturer of the engine being replaced, and certified to the provisions of the section, is available. This language should replace the proposed language in section 1068.240(b)(3) for land-based nonroad engines. Manufacturers simply do not have the resources to be intimately familiar with the entire product line of all CI engine manufacturers to be able to determine that no certified engine with the appropriate physical or performance characteristics is available for the repower. One manufacturer pointed out in subsequent discussions that their current production of replacement engines produced under §89.1003(b) is well below 1 percent of their total production.

Our Response:

We are concerned that ever-tightening emission standards will increase the incentive for users to request exempt replacement engines to avoid purchasing compliant engines. However, we agree in principle that the previous framework in §89.1003(b) places an appropriate and reasonable expectation on manufacturers to ensure that compliant engines are in fact not available with the necessary physical or performance characteristics. To address our remaining concerns about leaving a loophole that would allow users to circumvent the regulations, we note that we may ask manufacturers to report to us annually how many exempt replacement engines they have produced. As we learn more about how this exemption works out in practice, we can address any problems that surface.

9.8.7 Importing Engines

9.8.7.1 Requirements

What Commenters Said:

Section 1068.315(f)(2)(i) and (ii) contain requirements that differ from section 89.611(c)(3). Section 1068.315(f)(2)(i) should be removed from the proposed rule in order to eliminate the requirement that the engine has to be owned for one year. Also, section 1068.315(f)(2)(ii) should be amended to allow the engine to be sold, leased, donated, traded or otherwise transferred after one year, rather than five years.

Our Response:

The provisions in §89.611(c)(3) are ambiguous with respect to the two issues EMA raises. Part 89 requires that these engines be owned by the importer and not be imported for resale, which implies that the engines are supposed to be for private use. Requiring that the engine be owned before importation clarifies this and prevents dealers and other commercial importers from circumventing certification for engines that are owned on a very short-term basis. We believe that this period can be shortened to six months to be more flexible without compromising the effectiveness of these controls.

Also, §89.611(c)(3) has no provision for selling the exempted engine after importation, so specifying a five-year period after which the engine may be sold is in fact a liberalization of the current program. We believe the five-year period is an appropriate restriction to allow normal business practices without creating a problem with engines that are imported under this exemption to circumvent the regulations.

9.8.7.2 Display Engines

What Commenters Said:

Section 1068.325(c) differs from the current requirement at section 89.611(c), which allows an exempt engine to be permanently admitted into the U.S. if it meets the requirements of the section. Display engines should be included under section 1068.320 (imported engines with a permanent exemption), because there may be circumstances where a display engine needs to remain in the U.S. permanently.

Our Response:

Note, as described above, that we would expect manufacturers to import display engines under the manufacturer-owned exemption, which allows for permanent admission. The provisions of §1068.325(c) relate to engines imported under the display exemption. In contrast, §89.611(c) allows for permanent admission of certain engines, but display engines are not covered by this provision. We believe the proposed provisions set appropriate restrictions on these exemptions. In particular, display engines imported for the commercial interests of companies other than engine manufacturers should not be granted permanent admission.

9.8.7.3 Engines Imported Under Diplomatic or Military Exemptions

What Commenters Said:

Section 1068.325(e) differs from the current requirement at section 89.611(d), which allows an engine imported under a diplomatic or military exemption to be permanently admitted into the U.S. if it meets the requirements of the section. Diplomatic/military engines should be included under section 1068.320 (imported engines with a permanent exemption), because there may be circumstances where a diplomatic or military engine needs to remain in the U.S. permanently.

Our Response:

The provisions of §89.611(d) specify that diplomatic or military engines may be imported without bond, but do not provide for permanent admission. Under part 89, an imported diplomatic or military engine may never be finally admitted into the United States. Part 1068 should continue this policy.

9.8.8 Hearing Provisions

What Commenters Said:

The hearing provisions referenced in 40 CFR Section 86.1853-01 should be similar to section 89.127 which stipulates how a hearing is requested. These provisions cannot be applied to Selective Enforcement Audit (SEA) cases. Currently, at section 89.512, 513 and 514, specific provisions exist which outline how a public hearing is requested, the Administrative procedures for a public hearing, and the hearing procedures. Section 40 CFR 86.1853-01 does not contain any of this information and only outlines how a certification hearing is to be conducted. Manufacturers currently have an opportunity for a public hearing in the case of an SEA, but the language in proposed section 1068.601 would eliminate this right and would impose a hearing requirement that is inherently different than what is currently allowed, does not necessarily apply to an SEA case, and is unclear. In the case of SEA's, EPA should incorporate the hearing provisions at 89.512, 513 and 514 into 1068.601.

Our Response:

The provisions of 40 CFR 89.127 generally give manufacturers instructions in asking for a hearing. We have incorporated those changes into the regulations at §1039.820 for all cases where a manufacturer would request a hearing under the provisions of part 1039.

Regarding the hearing procedures for situations involving SEA and ABT, we disagree with the comment suggesting that the procedures specified in §1068.601 cannot be applied. While the hearing procedures in §1068.601 are somewhat different than those specified in 40 CFR part 89, we believe they are fair and reasonable. With the objective of harmonizing hearing procedures for all engine categories in the future, we intend later to revisit the issues raised in the comments. We may at that time conclude that the approach recommended by EMA is appropriate.

9.8.9 Separate Shipment of Aftertreatment Devices

What Commenters Said:

EMA had several comments related to the draft regulatory language that would allow manufacturers to ship engines without aftertreatment devices that would be needed for the engines to be in their certified configuration. (1) EMA suggested that it would be sufficient to include the cost of the aftertreatment devices in the cost of the engine, and that this would remove the need to have a contractual agreement with the equipment manufacturer. Also, this costing requirement should apply only when if there is no contractual agreement. Also, the agreement between engine and equipment manufacturers should not necessarily be a contractual agreement. (2) Manufacturers should be able to specify parameters for aftertreatment, rather than arranging for shipment of specific components. The proposed limitation would prevent market competition between component suppliers and introduce logistical issues. (3) It is unreasonable to audit every affected equipment manufacturer annually. Also, such an audit should only involve confirmation of part numbers for equipment manufacturers buying more than 50 engines per year. (4) A temporary label should not be required, since it adds cost without adding any value. (5) The regulations should not repeat that manufacturers' are liable for in-use compliance.

Our Response:

We disagree with EMA's assertion that either a costing arrangement or a contractual agreement alone would meet the need to ensure compliance with the regulations. The agreement must be in place and must be contractual, since there is a need to legally obligate the equipment manufacturer to fulfill the assigned role. Also, it is important to include the cost of aftertreatment in the cost of the engine, for example, as a way of preventing the incentive for equipment manufacturers to forego what could be seen as an unnecessary expense.

The application for certification requires a description of the emission-control system, including part numbers of any emission-related components, further engine manufacturers must warrant that emission componentry, including aftertreatment will last for the useful life of the engine and that the engine will meet standards for its useful life. Aftertreatment can be complex and involve a wide range of technical issues, such as substrate choice and design, heat management, packaging. It is not appropriate to expect equipment manufacturers to obtain proper and durable aftertreatment devices by following performance or design criteria supplied by the engine manufacturer.

We do not agree that the "separate shipment provisions" would prevent market competition between component suppliers and introduce logistical issues as EMA asserts. There will still be competition between component suppliers to supply aftertreatment devices for nonroad engines under a system that requires contractual agreements and requires the cost of aftertreatment to be included in the price of the engine. While EMA didn't identify specific logistical issues, we believe allowing engine manufacturers to ship aftertreatment systems with the engines or arrange for shipment directly to the equipment manufacturer actually solves many logistical issues and provides an opportunity to avoid the costs and logistical problems of handling the aftertreatment systems at the engine plant and reshipping them to the equipment manufacturer.

We agree that annual audits of each affected equipment manufacturer would be overly burdensome. We have therefore modified this provision to require regular audits such that an engine manufacturer would generally select each equipment manufacturer once over a four-year period. The scope of the audit is appropriately broad to ensure that equipment manufacturers are meeting their contractual obligations to assemble the engines and equipment consistently with the engine's certified configuration. Also, we have included a threshold of 50 engines per year, but we apply this to an engine manufacturer's total production under this provision. If a manufacturer sells fewer than 50 engines per year involving separate aftertreatment shipment, no auditing is required.

We believe that a temporary label or tag is an important step in ensuring that engines are fully assembled with aftertreatment devices before being installed in equipment. This would apply especially to those cases where an engine would for any reason be in the possession of someone who could mistake the engine as a completed product that was in its certified configuration. Since the engine manufacturer applies the permanent emission control information label, the temporary label makes clear that the engine is not complete yet.

Given the risks involved in shipping complete engines that are not yet in their certified configuration, we believe it is appropriate to spell out clearly the extent of liability for engine and equipment manufacturers under this provision.

9.9 Defect Reporting

9.9.1 General Concerns

Except as noted in the text below, all the comments related to defect reporting were from the Engine Manufacturers Association (OAR-2003-0012-0656, 0657; p. 72 - 78).

9.9.1.1 Complete Engine Components

What Commenters Said:

Part 1068, Subparagraphs 501(a)(1) and (b)(1) indicate that a possible or actual emission-related defect for any part of the engine would result in the complete engine being classified as having a possible or actual emission-related defect. Disparate issues relating to different parts on the engine would be combined in making the determination of whether the defect investigation and reporting thresholds are met with respect to "complete engine components." This could lead to the illogical result that the thresholds will be exceeded for virtually all "complete engine components."

Our Response:

Identifying complete engines as components for tracking purposes means that shipping a replacement engine or recording a warranty claim that cannot be attributed to a specific engine component or assembly should be considered a possible defect under the provisions of §1068.501(b)(1). When nothing more is known than that the engine was warrantied, the engine is counted towards the investigation threshold. Specifically, connecting rods and similar components are not on the list of emission-related components, so if investigation shows that connecting rods, or similar components are defective, an engine containing them will not be counted toward the reporting threshold. Warranty claims, parts shipments, hotline complaints, etc that relate to an emissions-related part shall be considered as "possible" defects only for the purpose of determining whether an investigation should be initiated. The investigation can be as focused as needed to determine if, in fact, an actual defect exists. Also, high emissions are to be counted as a potential defective engine for triggering an investigation. As discussed above if an investigation is required, a more specific cause may be counted as a defect for reporting purposes.

9.9.1.2 Definition for Emission-Related Defect

What Commenters Said:

The definition for "emission-related defect" should be restricted to include only defects that degrade emission performance. In defining the thresholds for conducting a defect investigation (Part 1068, Section 501(e)), EPA sets the thresholds based on the "number of engines that may have the defect." However, this term is not defined and to clarify the intent, it should be replaced with the phrase "number of engines with the possible defect" (Note that Part 1068, Subparagraph 501(b)(1) defines a "possible defect"). Also, the requirements of the defect reporting proposal apply to all emission-related components. Under this very broad definition, the number of components that could be considered emission-related would be very large, which is burdensome with respect to tracking, investigation, and reporting, and unnecessary since many of these components are only tangentially related to emissions.

Our Response:

We agree that the regulatory text should refer to "the number of engines with the possible defect." We have redefined the scope of the defect-reporting requirements so that it involves the same components that are covered by the warranty requirements applicable to new engines. This avoids unnecessary confusion related to whether a part is covered by one or the other or both requirements. We believe any defect in one of these components should count toward the investigation and defect-reporting thresholds, rather than trying to differentiate which defects would increase emissions. If a part is an emission-related component that is already subject to warranty requirement, it is already identified as affecting emissions, so it would not be appropriate to ignore defects that someone may judge to be somehow unrelated to emission control.

9.9.1.3 Defect Reporting Thresholds

What Commenters Said:

The language defining the defect reporting thresholds (Part 1068, Section 501(f)) indicates that the thresholds are based on possible defects. Since the defect reporting thresholds are numerically less than the defect investigation thresholds, defect reporting would be required when those very low thresholds were met and before any screening of possible defects, which is counter to the preamble discussion that seems to suggest a two-step process where a possible defect is initially investigated, then only included in defect reporting after it is verified as an actual emission-related defect. Subparagraphs 501(d)(3) and (4) refers to "engines that may have the defect," which adds to the confusion about whether the defect report is required before or after the conclusion of the defect investigation. These paragraphs should refer to "engines that have (not "may have") the defect."

The defect investigation and reporting thresholds are based on engine family sales. However, total family sales are typically not known until the end of the model year. As a result, the threshold values and the exceedances of those values cannot be determined until after the end of the model year, which could be inconsistent with EPA's intent.

Special defect investigation and reporting thresholds are given for "a catalytic converter (or other aftertreatment device)." However, in subparagraph 1039.240(c), "particulate traps" are distinguished from other aftertreatment technologies for the purpose of defining deterioration factors. EPA should clarify whether this distinction will be defined for these thresholds.

Our Response:

We agree that the text should refer to "engines that have the defect." This clarifies that the intent of the proposed requirements was to investigate when the number of unscreened possible defects exceeds a relatively high threshold and to report when the number of confirmed defects exceeds a smaller threshold.

This approach allows us to tailor thresholds to family size. In fact, the only constraint introduced by a percentage approach is that manufacturers will generally not be able to determine that an investigation or a defect report is necessary before the end of the model year. Since most defects occur after engines have been in service for several months, we do not consider this a significant problem. Manufacturers must report to EPA their sales volumes for each engine family within 30 days after the end of the model year (see 89.125(b) and 1039.250(a)).

Our Response:

Aftertreatment is a defined term in §1068.30, so this should not be unclear. However, the approach we are taking in the final rule removes the observed distinction for aftertreatment components.

9.9.1.4 Defect Reporting and Recall Provisions

What Commenters Said:

The defect reporting and recall provisions in Part 1068, Subpart F, were developed for large nonroad SI engines and recreational SI engines, which EPA now proposes to apply to nonroad CI engines of all sizes without making any changes to the overall structure of the regulations and only small changes to the specific requirements. CI engines differ from nonroad and recreational SI engines in a number of ways, including design, usage, life, production volumes, distribution and service channels, and commercial relationships between the engine manufacturers, equipment manufacturers and end users. Therefore, it should not be assumed that these requirements can be successfully applied to nonroad diesel engines.

Our Response:

The new defect-reporting provisions currently apply only to Large SI engines and recreational vehicles, but they were designed for the whole range of highway and nonroad engine categories, as evidenced by the threshold values for engines over 560 kW. We have nevertheless made adjustments to the proposed defect-reporting requirements. Reflecting our original intent to adopt a uniform program for all categories, these changes apply equally to the other engine and vehicle categories already subject to the original defect-reporting requirements in 40 CFR 1068.501.

9.9.1.5 Warranty Claims

What Commenters Said:

The proposal requires manufacturers to track warranty claims for emission-related components and to classify each such claim as a possible defect, which is inefficient and burdensome for manufacturers. Warranty claims are submitted for a number of reasons that may not be indicative of an emission defect. Even though these claims could be an indicator of emission defects it is very imprecise and would substantially overestimate the number of components having a defect that is associated with potential in-use emissions. EPA should not include specific requirements for warranty tracking or impose specific warranty claim thresholds for defect investigations and reporting.

Our Response:

We believe the concern expressed in this comment supports the proposed approach of setting up separate thresholds for investigating a relatively large number of possible defects, then requiring reports for a relatively small number of confirmed defects.

9.9.1.6 Tracking

What Commenters Said:

Under the proposal, manufacturers must track shipments of emission-related parts and for each part shipped, "other than for normally scheduled maintenance during the useful life of the engine," the component must be classified as having a possible defect. EPA should clarify that replacement parts shipped from manufacturing to warehousing locations are not included and should recognize that dealers, distributors and other service centers routinely maintain stocks of replacements parts. Making the assumption that there is a defective part for each replacement part shipped to a servicing location is erroneous and would overestimate the number of potentially defective parts. The final rule should not include specific requirements for tracking part shipments and should not impose specific thresholds for defect investigations and reporting based on part shipments.

The Motorcycle Industry Council (OAR-2003-0012-0685, p. 1-3) expressed similar concerns, recommending that EPA eliminate the requirement to track and count shipments of parts as an indicator of a possible defect. They emphasized that this requirement is very burdensome, since manufacturers do not currently use parts tracking systems that record the level of detail necessary to implement the rule. In many cases, it is impossible to link a specific part to any particular engine family. In addition, this requirement adds little value as an indicator of a possible defect since customers purchase spare and replacement parts for many reasons that are unrelated to defects. EPA should revise its regulations to accept only warranty claims, hotline complaints, and similar information from dealers as an indication of a potential defect, which would be consistent with the approach taken under the TREAD Act (49 CFR 579.23(c)). The comments from the Motorcycle Industry Council included additional discussion on this issue and specifically recommends that the phrase "parts shipments" and paragraph (ii) be removed from Section 1068.501(b)(1).

Subparagraph 501(a)(4) allows manufacturers to use alternate methods for tracking defects. Even though this appears to provide some flexibility, subparagraph 501(b)(1) requires manufacturers to track warranty claims, part shipments and "any other information." Thus, any other information source that a manufacturer might propose to use as an alternate tracking method is "other information" and is already required to be used under the base program. This undermines the apparent flexibility offered by subparagraph 501(a)(4).

Our Response:

After pursuing a variety of alternatives to clarify the proposed requirement to track parts shipments, we have concluded that there is not a workable approach to define a numerical approach to active tracking parts shipments and compare volumes to a specific threshold. For parts that have scheduled maintenance, the shipment volumes would be so great that it would be unrealistic to use that information to find defects. Some parts may be used in a large number of legitimately noncompliant engines, such as those used in stationary applications, exported to other countries, or produced before emission standards started. Also, parts shipments would be based on calendar-year data, since shipped parts are not tied to specific model years. This would make the parts-shipment data incompatible with the warranty information, which is based on model-year information. As a result, we are eliminating the requirement to set up a numerical parts-tracking system. We have included in the final rule a more general requirement to investigate a possible defect if parts shipments substantially exceed normal or expected levels.

The proposed approach to allow alternate methods is not specifically related to finding alternate information sources. We continue to believe that some manufacturers may have a unique situation with their product mix, their marketing arrangement, or their relationship with the distributors or suppliers that would lead to a different approach to tracking possible defects that would be as effective as the global approach identified in the regulations.

9.9.2 Specific Concerns Related to Investigation and Defect-Reporting Thresholds

9.9.2.1 General

What Commenters Said:

With respect to the investigation of defects, the proposed rule does not provide any criteria that are to be used to determine if a "possible defect" is an "actual defect." Typically, the information available from warranty and part shipment records is insufficient to determine if each claim or shipment is associated with an actual emission defect and it will be difficult to assess whether the records are "double counting" the number of parts replaced. As a result, many investigations will prove to be inconclusive.

Paragraph 1068.501(g) states that for the purposes of determining whether the defect investigation threshold has been met, any corrected defects are to be counted before they reach the ultimate purchaser, except for purposes of determining if the reporting threshold has been met. The reason for this distinction is unclear. Defects that are in fact corrected before an engine enters commerce should not be counted for any purpose since a corrected defect is no longer a defect. Manufacturers' internal quality control procedures are designed to find and correct problems prior to entry into commerce and problems identified in this manner should not contribute to thresholds used for reporting or investigation.

Paragraph 1068.501(h) requires the submission of a report with all the information required in a defect report even if the threshold for defect reporting is not met following completion of an investigation. This provision renders the reporting thresholds meaningless and should be removed.

Our Response:

Before a manufacturer starts an investigation, it is clear that possible defects will often never be identifiable as actual defects. Where it is clear that a possible defect that contributes to reaching the investigation threshold is an actual defect, it should be counted as a defect for evaluating whether the manufacturer exceeds the defect-reporting threshold for that component. Otherwise, we require only that manufacturers start to differentiate between possible and actual defects after an investigation begins. The whole purpose of the investigation is to make this differentiation, so we don’t believe this is a problem after the manufacturer exceeds the investigation threshold. This is especially true for warranty claims.

These corrected defects should not be counted only if the quality procedures that led to correcting the defect apply equally to all production engines. If partial or statistical sampling led to a corrected defect, then there is no assurance that other engines have been shipped with the defect. The proposed approach is therefore appropriate, though if the manufacturer makes corrections as part of a routine 100-percent quality check, this is simply a part of normal production procedures and it qualifies as neither a possible nor an actual defect.

The proposed requirement to send investigation reports specifies generally that the information should be the same as that of a final defect report, with two primary differences. First, we allow manufacturers to omit any information that is not relevant to a finding that the number of defects does not exceed the defect-reporting threshold. Second, the principle objective of the defect report is to report that the number of defects exceeds the applicable threshold, which may lead to remedial action. There is no provision for remedial action following an investigation report showing that the number of defects do not (yet) exceed the applicable threshold.

9.9.2.2 Additional Comments on Reporting, Tracking, and Investigations

What Commenters Said:

The proposed approach for defect reporting is impractical and overly burdensome for nonroad diesel engines. The approach currently used for highway, nonroad and marine diesel engines is preferable. EPA has not provided information suggesting that the identification, reporting and correction of defects is inadequate under the existing approach and in addition, has not demonstrated that the new defect reporting scheme is necessary. The proposed thresholds are much too low and will trigger unnecessary defect investigations and reporting. If specific thresholds are used for nonroad diesel engines, EPA should consider the small size of engine families, the long useful lives and warranty periods, the wide variety of operational conditions, and the tracking methods and the tendency of these methods to overestimate actual defects. EPA should also consider the fact that most nonroad engine manufacturers do not maintain any type of database for tracking or distinguishing among warranty claims or shipments of part replacements and thus, no system upon which a defect reporting program can be based. Detroit Diesel joined the Engine Manufacturers Association in expressing these comments.

The elements of a reasonable defect reporting program should include the following thresholds and requirements. First, the number of potential defects that trigger reporting should be the same for nonroad engines with or without aftertreatment systems (reducing the threshold by 50 percent for aftertreatment systems is unnecessary). Second, the minimum threshold for the initiation of any investigation should be 50 possible defects. Manufacturers could use warranty data bases quarterly to assess whether the threshold has been met, after which the manufacturer could monitor and investigate any further warranty claims and submit a defect report to EPA for those that are determined to be actual emission-related defects. For larger engine families greater than 1,250 units, the threshold could be scaled up using the 4 percent calculation method. EMA provided additional discussion on their proposed approach including a graphic of the relevant screening thresholds as the engine family sales volumes increase.

Duplicative programs are inherently unreasonable and unjustified. In that regard, EPA must take into account the manufacturer-run in-use testing program that EPA is proposing. EPA should ensure that there is no duplication between any finalized defect reporting and in-use testing requirements. Otherwise, both programs will fail to satisfy the mandated criteria for reasonable regulations.

In discussions following the end of the comment period for the proposal, engine manufacturers provided additional feedback regarding an appropriate defect-reporting scheme. They generally reiterated the recommendation in the written comments, with a few adjustments:

- They noted that their comments apply equally to engines above 560 kW; they did not support smaller thresholds for those engines.
- Requirements to track information from warranty claims, dealers, field-service personnel, hotline complaints, or engine diagnostic systems were reasonable, as long as the corresponding thresholds were appropriate.
- A requirement to monitor parts shipments was reasonable, as long as there is no quantitative assessment or applicable thresholds.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 4
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 76-78

Our Response:

In the preamble to the proposed rule, we described the basis for the new approach to defect-reporting. In summary, we believe that the old approach under 40 CFR parts 89 and 85 was inadequate for two main reasons. First, there was no obligation for manufacturers to look for information related to defects. We believe this is not appropriate, especially considering that manufacturers have a natural incentive to find and correct defective components in their engines. Second, the old approach set a defect-reporting threshold of 25 units, which did differentiate between very large and very small engine families. This leads to an excessive number of reports from large engine families, while significant defects from smaller families go unreported.

The anticipated program to require in-use testing of nonroad engines will be a focused effort to measure emissions from a small number of engines to evaluate whether engines' emission-control systems are working according to design. Defect-reporting requirements are aimed at broad information across the engine family that may provide insight regarding the reliability of specific engine components. We therefore do not believe these two programs will pose duplicative requirements.

We have considered a wide range of alternative approaches in establishing the appropriate thresholds for investigations and defect reports. In general, we believe we have found an approach that allows us to reconcile our interest in having thresholds that identify significant defects (possible and actual) with the manufacturers' concern about triggering the thresholds too frequently. The final rule includes several aspects that affirm the manufacturers' comments, including the following:

- Parts shipments are not subject to the threshold requirements, as described above.
- The same thresholds apply to aftertreatment and all other emission-related components.
- Defect-reporting should be based on a nominal failure rate of 2 percent.

The final rule includes the thresholds described in Table 9.9-1. These values are an outgrowth of our current programs that generally specify a defect-reporting threshold of 25 units. For engine families with sales of 1,250, this same threshold would apply. Many families have higher sales volumes than this and would have a correspondingly increased defect-reporting threshold based on 2 percent of total sales. Many families also have smaller sales volumes that would have correspondingly decreased defect-reporting threshold (also based on 2 percent of sales). We believe this is appropriate, since the thresholds still reflect a level of defects that is substantial and warrants further attention, and possibly remedial action. This is especially true for high-power engines, which are typically used with higher operating hours and load factors, and are monitored much more closely for defects. Fixed thresholds apply for very small families, as shown in Table 9.9-1. This allows for a higher percentage defect rate to address the fact that an infrequent defect should not be reported, even if it does represent a relatively high percentage occurrence.

The same approach applies to the investigation threshold, except that the threshold is based on a rate of 10 percent of total sales. This is higher than the 4 percent rate recommend by manufacturers, but we feel this is appropriate as a way of focusing manufacturers' efforts on finding likely defects and avoiding an excessive paperwork burden.

Table 9.9-1
Investigation and Defect-reporting Thresholds for the Final Rule

Engine Size	Investigation Threshold	Defect-reporting Threshold
≤ 750 hp	less than 500: 50 500-50,000: 10 % 50,000+: 5,000	less than 1,000: 20 1,000-50,000: 2 % 50,000+: 1,000
> 750 hp	less than 250: 25 250+: 10 %	less than 150: 10 150-750: 15 750+: 2 %

9.10 Engine Labeling

It is important to note before addressing the individual comments in this section that we have agreed to pursue an effort to conduct a comprehensive review of certification labeling requirements in the near future. This effort will likely address labeling requirements for all our nonroad programs. The positions we are taking in this final rule reflect our agreement with several of the comments raised in this rulemaking. For issues where we are choosing to depart from the manufacturers' recommendations, we give a rationale for adopting the positions included in this final rule. Since we are open to further consideration of these issues, the decisions and rationale in this section should not be interpreted as our final position; however, any further consideration of these issues will need to address the concerns we express in our responses to the comments in this section.

Except as noted in the text below, all the comments related to certification labeling were from the Engine Manufacturers Association (OAR-2003-0012-0656, 0657; p. 79 - 82) and from Detroit Diesel Corporation (OAR-2003-0012-0783, p. 7).

9.10.1 Labeling Requirements for Certified Engines

9.10.1.1One-Piece versus Two-Piece Labels

What Commenters Said:

Section 1039.135(b)(1) states that the label is to be "attached in one piece so it is not removable without being destroyed or defaced." However, this implies that the label can only consist of one part, which may be problematic if EPA retains all of the proposed labeling requirements. There is a limited amount of space on emission labels today and a limited number of locations on the engine which can accommodate the label and comply with all of the requirements. Manufacturers should be able to use multi-piece labels. CNH Global supported this concern.

Our Response:

There are three principal advantages to one-piece labels. First, enforcement efforts, generally by EPA or Customs inspectors, are typically much more straightforward if all the label information is together in one location. Second, one-part labels reduce the risk of counterfeit labels, since the manufacturer would not want to repeat information on both labels, including some information that may be helpful in preventing counterfeiting efforts. Third, manufacturers have expressed a concern that maintaining large numbers of unique labels is becoming overly burdensome.

While these factors lead us to strongly prefer one-part labels, we are aware that some small engines may simply be unable to accommodate the need to include all the prescribed information on a one-piece label. The final regulation therefore adopts a general requirement to use one-part labels and includes a separate provision to allow manufacturers of engines below 19 kW use a two-part label where necessary. In addition to the clear space constraints for engines below 19 kW, there is the added consideration that it would not be difficult to find both parts of a divided label on an engine of that size.

9.10.1.2Lettering Requirements

What Commenters Said:

The requirement in Section 1039.135(b)(4) states that the label be written in block letter in English." This may be problematic for manufacturers that do not use block lettering on their labels. In this context, EPA should retain the language of Section 89.110(a)(4). It should be sufficient to require the label to be "legible" as stated in Section 1039.135(b).

Our Response:

We agree that it is appropriate to require that labels be legible, but we should not require block lettering specifically.

9.10.1.3Information Required for Labels

What Commenters Said:

The new heading proposed in Section 1039.135(c)(1) is preferred since it more accurately represents the information being conveyed by the label.

The proposed requirement at Section 1039.135(c)(1) for manufacturers to include the manufacturer's full corporate name and trademark could be problematic. Engine manufacturers commonly manufacture engines for customers that require a "branded" engine, which bears the customer's name. Because the certificate holder's identity is indicated in the EPA engine family name, EPA should allow the engine customer's name and trademark (or no corporate trademark) to appear on the label.

Our Response:

We will continue to refer to the label as the emission control information label, as proposed.

We believe it is appropriate to allow manufacturers to produce engines with another company's band name on the emission label, with certain conditions. This provision depends primarily on the certificate-holding manufacturer having a contractual agreement with the other company to make sure the other company meets emission-related warranty obligations and reports this information to the certificate holder. The engine manufacturer must also describe the plan for utilizing this provision in the application for certification. In addition, it is important to note that applying a different company's trademark to the emission control information label in no way changes the certifying manufacturer's responsibility to meet all the applicable regulations.

9.10.1.3.1 Emission Control System

What Commenters Said:

The requirement in Section 1039.135(c)(3) identifies the emission control system with names and abbreviations consistent with SAE J1930. However, having the proposed information on the label is unnecessary and would take up too much space on the label. The emission control system is already identified on the application for certification and, if necessary, can be determined from an alternative source, such as the owner's manual. The proposed rule contains language at Section 1039.135(e) that gives manufacturers the option to include this information in the owner's manual. In addition, SAE J1930 is limited to light-duty gasoline and diesel vehicles and heavy-duty gasoline vehicles.

EPA should eliminate the requirement in Section 1039.135(c)(4), since the proposed rule contains language at Section 1039.135(e) to allow for both the fuel and lubricant information to be listed in the owner's manual if there is insufficient room on the emission label.

Our Response:

We believe it is important for operators or EPA inspectors to be able to identify the primary emission-control components from the emission control information label. This allows for quick verification that the engine is still in its certified configuration. This is generally limited to three-letter abbreviations of the a small number of basic emission-control features—such as diesel particulate filters (DPF), smoke-puff limiters (SPL), or multi-port electronic fuel injection (MFI). We therefore expect this to add very little to the size of the label.

We believe that information related to fuels and lubricants may also be important to have readily available. On the other hand, including this information is not as important to us as keeping a one-part label, so the regulation allows the manufacturer to omit this information from the label if there is not enough room for it and the information is included in the owners manual.

9.10.1.3.2 New Language

What Commenters Said:

The proposed language under Section 1039.135(c)(6) differs significantly from the current certification statement. First, the requirement to spell out "US Environmental Protection Agency" does not add any value and takes up additional space on the label. Second, this section is inconsistent with the descriptor used in the certification statements for other engine applications, which use the words "conforms to," rather than the word "meets." Given these concerns, the compliance statement should remain as it is today in Section 89.110(b)(10) to ensure consistency with the compliance statements used in other applications.

Our Response:

Abbreviating the agency name to U.S. EPA is appropriate.

Regarding the choice of words to characterize how the engine meets applicable requirements, we believe language on the label should match that from the underlying certification statement to make sure there is no difference in meaning that could cause confusion. In both of these cases, the regulations now call for manufacturers to state that the engine “comply with” the applicable requirements.

9.10.1.3.3 Model Year

What Commenters Said:

Continuing to identify the model year in the certification statement is unnecessary, especially since manufacturers will be required to indicate on the label the emission standards with which the engine complies and since the model year can be identified by alternative means. This requirement also creates a burden associated with updating labels on an annual basis.

Section 1039.135(c)(8) requires manufacturers to "include EPA's standardized designation for the engine family (and subfamily, where applicable)." Manufacturers should have the option to either include the first "year" character of family name, or to not include this character at all when indicating the engine family name, which would eliminate the need to annually update labels.

Our Response:

We believe the engine should be clearly labeled with the appropriate model year, to help with both EPA’s general enforcement efforts and U.S. Customs enforcement at importation.

Engine families are covered by certificates issued on an annual basis. Accordingly, the engine family designation includes the character showing the model year to allow us to match up an individual engine to its unique certified configuration. It is crucial for EPA enforcement to be able to do this easily and quickly, which would not be possible if these labels lacked any identification of the engine's model year, as suggested in the comment. Additionally, we receive numerous requests from individuals and businesses for the certificate and certification information for a particular engine. The requestor need to be able to identify the model year of the engine through the engine family name so we can provide the certificate and accompanying information for the engine. Finally, we have learned from U.S. Customs staff that inspectors will compare the model year identified on the emission control information label to the condition and appearance of the equipment being imported in an effort to uncover possible counterfeit labels (e.g., a newer model year label on an older piece of equipment). As a result, we believe the advantages of maintaining labels that indicate the applicable model year provide advantages that outweigh the small incremental cost of updating labels.

9.10.1.3.4 Power Category

What Commenters Said:

Section 1039.135(c)(7) requires manufacturers to "state the emission standards to which the engines are certified, or the FELs if you certify the engine using the ABT provisions of subpart H of this part." The requirement to list applicable FELs is acceptable. However, the requirement to list the specific emission standards to which the engine family is certified is not acceptable. EMA opposes a requirement to list specific numeric limits, but supports language that would require specification of the certification tier and power category if the model year requirement in Section 1039.135(c)(6) is eliminated.

The requirement for maximum power or advertised power for all applications in Section 1039.135(c)(9) should be eliminated. The engine rating can be obtained by use of alternative means, such as a reader, which will confirm if a certified rating has been downloaded in the engine control module (ECM). However, if this requirement is retained, a manufacturer should have the option to state the engine's maximum power or advertised power at rpm, in English units (hp) or metric units (kW), on the emission control information label.

Our Response:

We agree that a label sufficiently identifies an engine if it lists the engine family name, the model year, the applicable tier of standards, and the power range that identifies which standards apply. Accordingly, we don't believe the label needs to have engine-specific power ratings or numeric values of the applicable standards. As noted in the comment, this does not apply to engines that are certified to a Family Emission Limit under the emission-credit program.

One exception applies for engines between 37 and 56 kW certified under the Option #1 or Option #2 standards from 2008 through 2012 model years. These engines may meet different PM standards, depending on the option manufacturers choose, so it is important for these engines to have the appropriate PM standard on the engine's emission control information label.

9.10.1.3.5 Displacement

What Commenters Said:

EPA should eliminate the requirement to state the engine's displacement in Section 1039.135(c)(9). This information is unnecessary on the label since it is already incorporated into the family name and is readily available elsewhere.

Our Response:

We agree that the displacement information embedded in the family name is sufficient for those families whose engines all have the same total displacement and per-cylinder displacement. However, for those families that can't be captured by a single displacement value, it is very helpful for EPA's oversight of regulated engines to be able to identify the specific engine configuration within the engine family.

9.10.1.3.6 Useful Life

What Commenters Said:

The requirement in Section 1039.135(c)(10) to state the engine's useful life should be removed. It is unnecessary since this information can be found elsewhere. Customers will be more likely to consult sources such as the engine's warranty booklet and regulatory authorities can find this information in the application for certification.

Our Response:

Since there is a clearly established default value for useful life, we agree that useful life information is not needed on the label, except in those cases where manufacturers certify their engines to a shorter or longer useful life than the default value, as allowed by the regulations.

9.10.1.3.7 Fuel Information

What Commenters Said:

The proposed Section 1039.135(f) should not include a requirement to label the engine with a fuel information label if this information can be found elsewhere. It is unclear whether this information is intended to be printed on a separate label or the emission control information label. This information could be considered to be redundant given the fuel information requirement under Section 1039.135(c)(4). Having to label both the engine and the equipment (at the fuel inlet) with a fuel-specific label is overly burdensome and it makes more sense to simply require that the equipment, not the engine, have a fuel-specific label.

The New York DEC (OAR-2003-0012-0786, p. 5) noted that EPA specifies the content of fuel pump labels for various distillate fuels in §§80.570-80.574. These sections use the phrase "non-highway diesel fuel" rather than "nonroad diesel fuel." The nomenclature of distillate fuels is already quite complicated, and we see no benefit to this change. EPA should retain the historical nomenclature "nonroad diesel fuel" for all purposes, including pump label language.

Our Response:

We believe it is generally beneficial for operators or EPA inspectors to be able to identify any relevant fuel information from the emission control information label. This allows for quick verification that the engine is operating consistently with its certified configuration. On the other hand, including this information is not as important to us as keeping a one-part label, so the regulation allows the manufacturer to omit this information from the label if there is not enough room for it and the information is included in the owners manual.

We have revised the separate discussions of the two fuel-related labeling requirements to clarify how they relate to each other. We continue to treat sulfur-related information separately, since this information is too important to be omitted from the engine, either because it is in the owner's manual or on the equipment.

9.10.1.3.8 Duplicate Labels

What Commenters Said:

The requirement for duplicate labels under Section 1039.135(h) should be eliminated, since it places a significant burden on engine manufacturers in the form of additional costs and record-keeping requirements and opens the opportunity to the fraudulent use of labels. EPA should not include provisions that 1) require the engine manufacturer to notify the OEM that a duplicate label is required if the engine label is obscured; 2) require the OEM to request a duplicate label from the engine manufacturer if the engine label is obscured; and 3) require the engine manufacturer to provide a duplicate label upon request, unless EPA absolves the engine manufacturer of any liability associated with the misuse of labels. Manufacturers noted that it would be difficult to keep a paper record of every request for a duplicate label from equipment manufacturers, pointing out that it would be much better simply to require a written documentation of each request (including documentation generated by the engine manufacturer).

Our Response:

We understand that duplicate labels will require a certain amount of effort and expense for engine manufacturers. This requirement is, however, already part of the current regulatory requirement under 40 CFR 89.110. We believe the revised regulation is an appropriate application of the principle embodied in the current regulation. Specifically, we believe the prescribed recordkeeping steps are necessary and sufficient to address concerns related to fraudulent labels. We have modified the proposed provisions to allow manufacturers to generate their own written documentation of incoming requests for duplicate labels.

9.10.1.3.9 Other

What Commenters Said:

EPA should eliminate the labeling requirements in proposed Section 1039.135(c)(11) and (12), since this information is more appropriately found in an alternative source (e.g. an owner's manual) and does not belong on the emission label.

The requirement in Section 1039.135(c)(13) to label constant-speed engines should be removed since the Original Equipment Manufacturer (OEM) and the customer know what type of engine they are purchasing and since this information can be found by searching the unit history.

For Section 1039.135(c)(14), EPA should consider alternative language similar to Section 86.095-35, which is more broadly written to allow the engine manufacturer to include other information as necessary. However, some modifications to Section 86.095-35 will be required to broaden the references to "state regulations" and "other regulations." Commenter (EMA) notes that they are willing to work with EPA to develop appropriate language for this provision.

Our Response:

We agree that it is not appropriate to require tune-up or maintenance information on the label. We have therefore changed the labeling provisions to allow manufacturers to ensure that the engine will be properly maintained and used, without requiring any specific information.

It is important that engine labels identify engines that have been certified only for constant-speed operation. This serves as an important communication to equipment manufacturers installing engines and rebuilders, especially those who do out-of-frame rebuilds. Labeling each engine as “constant-speed” is important to prevent inappropriate installation or recalibration.

The final rule includes language allowing manufacturers to add label language to identify other applicable emission standards and any recommended maintenance or use.

9.10.2 Other Labeling Issues

All the comments related to these other labeling issues were from the Engine Manufacturers Association (OAR-2003-0012-0656, 0657; p. 84 - 85).

9.10.2.1Guam, American Samoa, and Northern Mariana Islands

What Commenters Said:

The labeling requirements of 40 CFR 89.110 are inappropriate and unnecessary for engines sold in Guam, American Samoa, and the Northern Mariana Islands, and should be eliminated. It does not make sense to require the label to state that the engine conforms to the current model year standards and then to state that it is exempt from the current standards. Also, engines produced to comply with the Tier 3 standards will not be certified and as a result, the compliance statement in 89.110 cannot apply. In addition, it will not be possible to provide engine family name information. EPA should require a special label for engines sold in these areas that only includes the heading "Emission Control Information," the corporate name and trademark of the manufacturer, and the statement recommended in Section 1039.625. The same situation applies to engines produced under the exemption for the Transition Program for Equipment Manufacturer Flexibility.

Our Response:

We agree that these engines, while subject to the Tier 3 emission standards, are not part of a certified emission family. We have therefore modified the final rule to exclude the information specified in the comment. Other items from the certification label, such as manufacturing date and fuel-related information, is still relevant and must therefore be included on the label.

9.10.2.2Unique Labels

What Commenters Said:

Sections 1068.210(e), 215(c) and 220(e) specify three unique label requirements associated with the different exemption provisions. The requirement to create unique labels for each exemption would be costly and burdensome for the engine and equipment manufacturers. EPA should require a label for exempt engines that includes the heading "Emission Control Information," the corporate name and trademark of the manufacturer, engine displacement and model year, and the following statement: "This engine is exempt under 40 CFR 1068.210, 1068.215, or 1068.220 from emission standards and related requirements."

Our Response:

We agree that there is no need for manufacturers to differentiate engine labels for engines that are exempted as manufacturer-owned engines or as test engines. The display exemption is generally not intended for manufacturers, since they would more easily be able to exempt such engines under the manufacturer-owned engine exemption. We therefore are specifying a separate labeling provision for display engines.

9.10.2.3Engine Family Requirement

What Commenters Said:

The proposed requirement to list "engine family" is inappropriate because exempt engines can never be part of an engine family, precisely because they are exempt.

Our Response:

We include the requirement for “engine family identification (as applicable)”. This allows manufacturers to omit this information if it does not apply. However, manufacturers sometimes wish to convert an exempted engine’s status by including it under an existing certified engine family. The provision as described would allow manufacturers to anticipate this development without imposing an inappropriate requirement.

9.10.2.4Hardship Labeling Requirements

What Commenters Said:

Sections 1068.245(f), 250(k) and 255(b) specify three unique label requirements associated with the hardship provisions. The requirement to create unique labels for each of these provisions would be costly and burdensome for the engine and equipment manufacturers. EPA should require a label that includes the heading "Emission Control Information," the corporate name and trademark of the manufacturer, engine displacement and model year, and the following statement: "This engine is exempt under 40 CFR 1068.245, 1068.250, or 1068.255 from emission standards and related requirements."

Our Response:

We expect our economic hardship approvals to be quite rare (given that there has been but one application for such an exemption to date), so we would anticipate no cost saving with the suggested simplification of hardship labels.

9.10.2.5Imported Engines

What Commenters Said:

EPA should remove the proposed language under Section 1068.320 that would require imported engines with permanent exemptions to be labeled as such. Engine manufacturers export engines to a variety of OEMs throughout the world and it is almost impossible for an engine manufacturer to predict where the equipment is going to be operating after the engine is installed. EPA already proposes to require labeling for certified engines, TPEM engines, replacement engines and exempt engines. To require an additional label in this case, will only lead to confusion and will be unduly burdensome to manufacturers.

EPA should revise the provisions that apply to imported engines with permanent exemptions to avoid confusion associated with dual labeling. An engine manufacturer can build a stationary engine for an OEM that is located in a country that has different standards. This OEM-produced equipment will contain a stationary engine with an export label on it as required in Section 1068.230, but would also require the label specified in Section 1068.320 if the same piece of equipment were to be permanently imported into the U.S. An engine manufacturer will not know in advance whether both labels are required. Applying both labels could lead to confusion in other countries where the dual-labeled engines are being exported. Rather than imposing this burdensome and costly requirement, EPA should update the Customs Form to protect against the importation of engines that are not certified or properly exempt.

Our Response:

Except for stationary installations, manufacturers should generally know before shipping engines that they need to be labeled for the specific exemptions cited. The issues raised in the comment therefore apply only to stationary engines. In those cases, the labeling requirements should not be problematic, because exported engines do not need permanent labels. If a distributor or engine manufacturer would import a nonconforming engine back into the United States as stationary engine, the export label could simply be removed.

9.10.2.6 Replacement Engines

What Commenters Said:

EPA should revise the current nonroad replacement engine label requirements to tie the replacement engine to the manufacture date of the engine being replaced. The proposed language at Section 1068.240 ties the replacement engine to the build date of the nonroad equipment. However, nonroad equipment may have engines that were built in years prior to the year the equipment was built, due to engines being used which were in the OEM's inventory (as allowed under Section 89.1003(b)(4)). In addition, engine manufacturers have the ability to determine the manufacture date of engines they produce but may not necessarily be able to determine the manufacture date of the equipment, thus making it much more difficult to determine what type of engines can be manufactured for replacement purposes. EPA should revise the current nonroad replacement engine label requirements by adopting the following labeling language: "This engine does not comply with current Federal nonroad emission requirements. Sale or installation of this engine for any purpose other than as a replacement engine in a nonroad application in accordance with 40 CFR 1068.240 is a violation of Federal law subject to civil penalty." This provision should also be amended to include a section that allows manufacturers the option of applying to EPA for approval to use alternate label language that may be more accurate for the engine produced.

Our Response:

We agree that the label language for replacement engines should refer to the original build date of the replaced engine. Also, §1068.201(c) already allows us to approve alternate label language for any exemptions under Subpart C of Part 1068.

9.10.2.7 Other

What Commenters Said:

EPA should add a provision to Section 1039.230 that will allow manufacturers to include any other information on the emission control label that they deem appropriate.

Our Response:

The labeling requirements related to exported engines intentionally do not prevent a manufacturer from adding any other relevant information.

9.11 In-Use Compliance Margin

9.11.1 EPA Should Modify the Proposed In-use Compliance Margin Provision to Ensure That it Is Beneficial and Useful to Nonroad Engine Manufacturers

EMA commented that the effective dates for the NO_x and PM compliance margins or "add-ons" for engines in the 56 to 130 kW power range should be extended one additional year to apply from 2012 to 2016, rather than 2012 to 2015. Manufacturers of these engines are allowed to meet the final Tier 4 standards either in January 2014 or October 2014. For those that choose the October 2014 option, the in-use add-ons will only be available for 1.25 years following the model phase-in. Therefore, it is necessary to extend the period for add-ons to 2016, or at a minimum, October 2015, for this category.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 32, 111

DDC and EMA commented that the proposed threshold for allowing add-ons is set to be less than 2.0 g/kW-hr, compared to a split family standard of 2.0 g/kW-hr, for engines 130-560 kW. Therefore, nonroad engines certifying the split family or interim NO_x standards would not be eligible for the in-use add-on. The commenters recommended that the nonroad add-on threshold be set at 8 percent above the standard to be consistent with the on-highway rule, which for engines in the 130-560 kW power range would be 2.2 g/kW-hr. DDC specifically recommended that the three levels of NO_x add-ons should be 0.16, 0.25, and 0.34 g/kWh.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 5
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 33, 111

DDC and EMA also commented that EPA should allow add-on values at three different periods during the engine's useful life, instead of the two currently proposed. In the 2007 on-highway rule, different add-on values were set at three different periods during the engine's useful life. This same approach should be used for nonroad engines. To set equivalent thresholds for nonroad engines, add-ons should be set for less than 2,000 hours, 2,001 to 3,400 hours, and 3,401 to 8,000 hours.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 5
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 33, 111

EMA commented that the 2011/2014 nonroad NO_x standards are approximately 25 percent higher than the 2007/2010 on-highway standards. Similar percentage reductions are made from the previous Tier emission levels, but the starting point for nonroad engines is higher than for on-highway engines. Because of this higher starting point, an equivalent unexpected deterioration of an aftertreatment device on a nonroad engine would result in a greater absolute increase in emissions. Therefore, the NO_x add-ons should be adjusted by approximately 25 percent. EMA also noted that they are not recommending any changes to the PM add-on schedule that EPA has proposed and provided a table summarizing suggested changes for nonroad engine NO_x add-ons.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 33-34

Our Response:

As discussed in Section III.E of the preamble to this final rule, we continue to believe that allowing adjustments is appropriate. However, as also described there, we are revising them slightly from the proposed adjustments in response to these comments.

9.12 In-Use Testing

9.12.1 EPA Should Propose as Soon as Possible, Strong In-use Controls for Diesel Vehicles and Engines

What Commenters Said:

A number of commenters stated that EPA should develop requirements for on-board diagnostics and manufacturer run in-use testing programs to ensure that the emission standards are met throughout the useful life of the engines. The in-use testing program should involve both federal and state regulatory agencies to ensure an orderly transition to inspection and maintenance programs. Some commenters (CATF, NRDC, STAPPA/ALAPCO) recommended that EPA commit to a rulemaking on this issue as part of the current rulemaking and should adopt these program in advance of the effective date of the Tier 4 standards. Some commenters (CATF, et. al.) noted that EPA has not provided any justification for its decision to not include OBD requirements in the proposed rule.

<u>Letters:</u>
Clean Air Task Force, et. al., OAR-2003-0012-0508 p. 22
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 32-33
Pennsylvania Department of Environmental Protection, OAR-2003-0012-0699 p. 4
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 17
Union of Concerned Scientists, OAR-2003-0012-0830 p. 9-10
New York Public Hearing, A-2001-28, IV-D-05 [CATF p. 235]

NESCAUM commented that EPA should commit to a manufacturer-run, in-use testing program and OBD requirements as part of the current rulemaking. The implementation of smoke opacity I/M programs for the current fleet, on-board diagnostics, and alternative compliance programs for future nonroad equipment should all be addressed in the near term to ensure in-use compliance. Regarding the first component, several states have expressed an interest in extending the emissions benefits of the highway diesel smoke enforcement programs to the nonroad diesel sector. In this context, the lack of an in-use smoke testing procedure and associated federal guidance for nonroad sources has hampered state efforts to develop adequate smoke enforcement programs. EPA should add language in the final rule expressing its intent to develop I/M guidance covering nonroad-specific, in-use smoke test procedures and associated opacity cutpoints for the current fleet in the near future. Second, EPA should provide a specific timetable for developing OBD requirements for nonroad equipment, which should be implemented in advance of the standards to maximize their effectiveness. Finally, NESCAUM stated, EPA should focus on in-use compliance for the new fleets that will be emitting at very low concentrations since accurate in-use compliance will not be possible for these engines with the equipment that is currently available. EPA should plan to provide the framework for guidance for advanced emissions sampling techniques for future nonroad equipment.

Letters:
NESCAUM, OAR-2003-0012-0659 p. 9-10

9.12.2 Further Review Is Necessary in Order to Develop Adequate In-use Testing and On-board Diagnostics Provisions

What Commenters Said:

Caterpillar commented that in developing a plan for in-use testing and on-board diagnostics, EPA should first review the entire engine testing program including the certification program to avoid testing duplication and to ensure the most reliable and cost-effective emissions compliance program.

Letters:
New York Public Hearing, A-2001-28, IV-D-05 [Caterpillar p. 76]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [Caterpillar p. 84]
Chicago Public Hearing, A-2001-28, IV-D-06 [Caterpillar p. 62]

EMA noted that as part of the on-highway NTE settlement, EPA has committed to engage in a consultation process with EMA to develop an outline to serve as the basis for an NPRM for a manufacturer-run in-use testing program applicable to nonroad diesel engines and vehicles. However, this process has not yet begun. Before engine manufacturers can finalize their comments on issues related to in-use compliance, EPA and manufacturers must work together to establish the parameters of a manufacturer-run in-use nonroad test program.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 71, 111

9.12.3 EPA Should Ensure That States Do Not Use In-use Testing as a Mechanism to Impose Fees on Equipment Owners

What Commenters Said:

ARA commented that EPA should ensure that states do not use in-use testing as a mechanism to impose fees on equipment owners. Further, ARA stated, to help avoid this, EPA must develop a meaningful and extensive manufacturers' in-use test program that will generate sufficient data to prove that the emissions controls are durable over the useful life of the engine.

Letters:
American Rental Association, OAR-2003-0012-0612 p. 4

Our Response (to 9.12.1 - 9.12.3):

We plan to begin a rulemaking next year to establish a manufacturer in-use testing program for nonroad diesel engines. We will consider the need for OBD requirements after we complete the OBD regulations for heavy-duty diesel highway engines.

9.13 Other Engine and Equipment Manufacturer Issues

9.13.1 EPA Should Modify the Proposed Engine Family Definition at Section 1039.230

What Commenters Said:

DDC and EMA commented that the proposed engine family definition at section 1039.230 should be modified. They commented that engine bore and stroke should have an allowed tolerance of 15 percent variation in displacement to allow for engine models with minor variations in this regard.

The commenters further stated that the "number of cylinders (engines with aftertreatment devices only)" should be removed from the engine family definition criteria, since it will increase the number of engine families and the certification cost and will not benefit the environment. Lastly, the commenters stated that even though differing numbers of cylinders may require different sizes of aftertreatment, engines with the same number of cylinders may require varying aftertreatment due to various rated speeds and loads.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 8
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 90-91, 112

Euromot commented that EPA should allow engines with different cylinder numbers to be in the same engine family. We proposed using the number of cylinders as a criterion to define an engine family for aftertreatment systems. However, Euromot commented, allowing for engines with different cylinder numbers in one family would reduce the burden associated with certification; in this case, the engine manufacturer has to test the more unfavorable combination (Lowest ratio of catalyst volume to engine swept volume).

Letters:
Euromot, OAR-2003-0012-0822, 0823 p. 6

Our Response:

We agree that manufacturers should be allowed to group together engines with similar emission characteristics but different numbers of cylinders in the same engine family.

9.13.2 EPA Should Establish Non-conformance Penalties (NCPs) as Part of the Tier 4 Rulemaking

What Commenters Said:

DDC and EMA commented that 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 some engine families to comply with the standards. The availability of NCPs is critical to the nonroad engine and equipment marketplace. NCPs provide a temporary alternative, permitting manufacturers to continue to sell their engines or equipment if they are initially unable to comply with the new strict standards. These manufacturers would otherwise be forced out of the marketplace. The amount of the penalty and the degree to which the non-conforming engine family may not exceed the applicable standard must be established well in advance of the implementation date. The best means to assure the use and application of consistent cost data is by establishing the NCPs at the time the underlying standards are established.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 8
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 90

The New York Department of Environmental Conservation commented that EPA Should establish non-conformance penalties (NCPs) as part of the Tier 4 rulemaking, but did not provide any additional discussion or supporting documentation.

Letters:
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 8

Our Response:

We are not establishing NCPs for the new standards at this time. At this time, we cannot conclude that NCPs will be needed. While we believe that substantial work will be required to meet the new 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 at this early stage of development, when implementation of these standards is still many years away, it may be appropriate to reconsider NCPs in a future action.

9.13.3 EPA Should Provide Manufacturers with Additional Flexibility with Respect to Meeting the Installation Instruction Requirements

What Commenters Said:

DDC and EMA commented that engine manufacturers should be allowed to meet the need for providing installation instructions to equipment manufacturers in different ways. For example, the engine manufacturer could provide written instructions with each engine shipped, written instructions that cover all the engines of a certain model sold to an equipment manufacturer, or a website reference that includes the applicable instructions.

Letters:
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 8
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 87

EMA also commented that the provision that requires engine manufacturers to inform OEMs that the exhaust system must be designed to allow exhaust samples to be obtained can only be achieved if specific information can be provided describing the exhaust sampling requirements, which may differ depending on the design of the exhaust measurement system used for in-use testing. In this context, EPA should work with EMA to develop written guidance that can be provided to OEMs.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 87

Our Response:

We agree that engine manufacturers should have the flexibility to use different means of providing installation instructions to equipment manufacturers, subject to EPA approval during the certification process.

9.13.4 The Equipment Manufacturer Should Be Responsible for Following the Engine Manufacturer's Installation Instructions

What Commenters Said:

EMA commented that the proposed section 1068.105 should remain as part of the final rule. Engine manufacturers should not be responsible for auditing the equipment manufacturers processes and should not have any liability associated with an equipment manufacturer's failure to follow the engine manufacturers installation instructions.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 88

Our Response:

We are not changing the installation requirements in §1068.105(b).

9.13.5 EPA Should Not Require the Aftertreatment System to Be Shipped from the Engine Manufacturer's Facility with the Engine

What Commenters Said:

CNH Global, DDC, and EMA commented that engines and aftertreatment systems are often assembled in different manufacturing facilities. In some cases, assembly of nonroad equipment may be completed in different manufacturing facilities with engine and exhaust system installation done in separate locations. In this case, a requirement to ship the aftertreatment system with the engine would involve extra time and expense for repackaging and reshipping, and would increase the potential for loss or damage to the aftertreatment system. The engine manufacturer should sell the engine and associated aftertreatment as a unit, but should be provided with some flexibility regarding the shipping method.

Letters:
CNH Global, OAR-2003-0012-0819 p. 5
Detroit Diesel Corporation, OAR-2003-0012-0783 p. 8
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 87

Ingersoll-Rand commented that the Tier 4 standards may provide engine manufacturers with an opportunity to specify a particular aftertreatment device, or they may require equipment manufacturers to buy the specified device with the engine. EPA should include provisions in the rule that ensure equipment manufacturers will have the option of purchasing emission control systems on their own, subject to operating parameters that would be specified by the engine manufacturers.

Letters:
Ingersoll-Rand OAR-2003-0012-0504 p. 19

Our Response:

We agree that engine manufacturers need to have the flexibility to ship engines and aftertreatment devices separately. We have added regulatory provisions to allow this with appropriate controls to ensure that this flexibility is not abused. For example, we require the engine manufacturer to identify the specific part, include the cost of the part with the cost of the engine, and arrange for shipment directly to the equipment manufacturer. It would not be appropriate to allow equipment manufacturers to specify aftertreatment devices, since neither EPA nor engine manufacturers would have sufficient assurance that the fully assembled engine would be in its certified configuration.

9.13.6 EPA Should Maintain the Proposed Provisions That Would Limit the Use of Auxiliary Emission Control Devices and Defeat Devices

What Commenters Said:

Environmental Defense, NRDC, STAPPA/ALAPCO, and UCS commented that EPA's proposed clarifications of the existing nonroad diesel engine regulations regarding defeat devices in light of the proposed additional emission test requirements and the certification reporting requirements with respect to the description of AECDs should be maintained in the final rule and should be applied to the current Tier 2 and Tier 3 programs. It is critical that EPA ensure that companies do not use the "engine protection" AECD claim to cover anything that could be termed a defeat device. AECDs have begun to be much more common with the Tier 2 standards, and this trend is likely to continue, with Tier 4 engines relying on sophisticated technologies that may employ very complex AECDs. Thoroughly disclosing the presence and purpose of AECDs is essential in allowing EPA to evaluate the AECD and determine whether it represents a defeat device.

Letters:
Environmental Defense, OAR-2003-0012-0821 p. 10-11
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 29-30
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 16
Union of Concerned Scientists, OAR-2003-0012-0830 p. 9-10

Our Response:

We agree.

9.13.7 Users of Nonroad Engines and Equipment Will Most Likely Operate Their Engines for Longer Periods than EPA Projects

What Commenters Said:

NRDC and UCS commented that EPA's current useful life projections are underestimated. In the highway diesel world, engine makers openly promote their "million-mile engines" despite EPA's 435,000 mile useful life. It is reasonable to assume that such a discrepancy also exists in the nonroad diesel world. EPA should analyze real world operating patterns, in order to ensure that its useful life assumption is accurate. One commenter (UCS) recommended increasing the regulatory useful life to 15 years or 14,000 hours. NRDC acknowledged that its belief that nonroad engines operate for longer periods than EPA's current useful life is based on somewhat on anecdotal evidence.

Letters:
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 32
Union of Concerned Scientists, OAR-2003-0012-0830 p. 8

Our Response:

We agree with the commenters that it is important that useful life accurately reflect actual usage rates. Given our best estimates of nonroad engine fuel consumption and engine populations, we believe that our useful life values are, at least on average, sufficiently long. Nevertheless, we recognize that there may be certain applications in which they are not long enough. We will reconsider our useful life values in the future if we determine that they are not appropriate. However, at this time we do not have sufficient data to justify any changes.

9.13.8 EPA Should Clarify the Requirements That Apply to Rebuilt Engines

What Commenters Said:

The Alaska Department of Environmental Conservation commented that rebuilt engines are common in Alaska. EPA should clarify the definition of rebuilt engines and where the line is drawn between fixing, modifying and completely rebuilding. EPA should also clarify whether the rules regulate rebuilds by individual owners or fleets, or only by larger engine manufacturer rebuild facilities.

Letters:
Alaska Department of Environmental Conservation, OAR-2003-0012-0607 p. 3

Our Response:

We believe the rebuilding engine provisions in §1068.120 are clear. In that section, we state:

> The term "rebuilding" refers to a rebuild of an engine or engine system, including a major overhaul in which you replace the engine's pistons or power assemblies or make other changes that significantly increase the service life of the engine. It also includes replacing or rebuilding an

> engine's turbocharger or aftercooler or the engine's systems for fuel metering or electronic control so that it significantly increases the service life of the engine. For these provisions, rebuilding may or may not involve removing the engine from the equipment.

We further state "rebuilding does not normally include scheduled emission-related maintenance or unscheduled maintenance that occurs commonly within the useful life period.

With respect to applicability, the regulations state that the requirement to rebuild engines to their certified configuration applies "to anyone rebuilding an engine subject to this part, but the recordkeeping requirements . . . apply only to businesses."

9.13.9 EPA Should Not Require Measurement and Submission of CO_2 Emissions

What Commenters Said:

EMA objected to the need to measure and report CO_2 emissions along with that from regulated pollutants. This was seen as especially problematic for those cases where the measurement method did not otherwise require CO_2 measurements.

Letters:
Engine Manufacturers Association, OAR-2003-0012-0656, 0657

Our Response:

We agree that manufacturers should not report CO_2 emissions if they are not collecting that data as part of their emission testing. However, if they are measuring CO_2 emissions as part of the overall effort to quantify emissions of other regulated pollutants, we believe it is appropriate to include this information in the application for certification. Seeing the CO_2 data will allow us to perform calculations to verify the validity of other reported emission data.

9.13.10 EPA Should Allow Multiple Cylinder Arrangements in a Single Engine Family

What Commenters Said:

Euromot recommended that EPA allow engines with different numbers of cylinders in a single engine family to reduce the burden of certification.

Letters:
Euromot, OAR-2003-0012-0822, 0823

Our Response:

We believe it is appropriate to specify cylinder count as a basic descriptor for distinguishing engine families, since engines with different cylinder arrangements could very well have different emission-control characteristics. However, the regulations allow the flexibility for manufacturers to group different engines into the same engine family if they are able to show that the different engines will have the same emission characteristics throughout the useful life.

9.13.11 Shorter Useful Life Values

What Commenters Said:

Engine manufacturers suggested that it was unnecessary to put useful life values on the emission control information label. Commenters did not specifically comment on the provisions related to establishing shorter useful life values.

Our Response:

We proposed to revise the provisions from 40 CFR 89.104 related to shorter useful life values. We are finalizing these provisions as proposed. However, recent experiences related to this type of provision from other programs has led us to consider that a different approach may be necessary. We anticipate making any changes to these provisions together for the various programs that would be affected to maintain appropriate consistency across programs.

10. REFINERY & FUEL DISTRIBUTION ISSUES

What We Proposed:

The comments in this section correspond to Sections IV and VIII of the NPRM, and focus on issues dealing with the proposed NRLM fuel requirements and refinery and fuel distribution issues (see Sections IV and V of the FRM). A summary of the comments received, as well as our response to those comments are located below. For the full text of comments summarized here, please refer to the public record for this rulemaking.

10.1 Fuel Markers

10.1.1 General Comments on Marking Provisions

10.1.1.1Request for Working Group on Marker Issues

What Commenters Said:

Octel-Starreon commented that EPA should form a multi-disciplinary working group to help develop and implement a fuel marking system. In developing the fuel marker system, EPA could follow a process similar to that used for the 1992-1994 introduction of fiscal marker Red 164. EPA should allow a reasonable amount of time for the working group to develop their conclusions. This type of process would lead to a greater degree of consultation with all stakeholders.

Letters:
Octel-Starreon LLC, OAR-2003-0012-0642 p. 7

ExxonMobil commented that a consensus process involving pipeline operators, refiners, marketers, and aviation fuel experts could be used to review and recommend the best marking system. Providing additional time for review may allow for candidate marker systems to be field tested in pipeline distribution systems to determine the effect on pipeline operations and to identify any unmarked product contamination issues. Therefore, Exxon stated, EPA should consider delaying the final selection of the specific marker system and dosage requirements until 2005 or 2006.

Letters:
ExxonMobil, OAR-2003-0012-0616 p. 16-17

Our Response:

We are confident that the notice and comment process has been sufficient to select an appropriate marker for use under today's final rule. We received extensive comment on the proposal and as discussed in sections IV and V.E of the preamble, we have had extensive discussions with the marker industry, refiners, fuel distributors, the FAA, IRS, ASTM and others to provide input in choosing the marker and its use for the final rule. In the end we have decided to stay with the proposed marker, but have significantly reduced the amount of fuel that will need to be marked in response to many of the concerns raised. The yellow marker is in fact the same marker Europe adopted after following their own process for selecting a marker. A more in depth discussion of the rationale for our decision is contained in sections IV and V.E of the preamble and in Chapter 5 of the RIA. Also as discussed in the preamble, if subsequent work by the FAA, IRS, and others yields a more appropriate marker that is also acceptable if it contaminates in jet fuel, then we remain open to revising our marker provisions in the future.

10.1.1.2Concerns with Marker Provisions

What Commenters Said:

We received comments from a number of commenters which stated that our proposed fuel marker provisions would complicate enforcement. These commenters all believed that we should reconsider the portion of the proposal that would establish a marker that distinguishes between heating oil and on/offroad fuel, that is not visible to the naked eye. Further, the commenters stated that the use of a marker that cannot be detected through a sight glass or the drawing of a sample from a fuel tank would open a regulatory loophole that could lead to evasion both of environmental standards and of federal excise tax laws and could complicate enforcement with both EPA and IRS regulations.

AOPL noted that EPA proposed that heating oil be marked with Solvent Yellow 124 during the first phase of the program, and proposed that in the second phase, Solvent Yellow 124 would no longer be used to mark heating oil but would be used to mark 500 ppm LM. The switching of mandated markers, stated AOPL, from one product to another has the potential to create confusion and difficulties with tank utilization, which in turn increases the risk that errors will be made by downstream parties when segregating one product from the next during the transition period.

Environmental Defense reiterates their position that if EPA implements the fuel sulfur standard in one-step, the issues associated with markers, labeling, and misfueling would be far less complicated.

<u>Letters:</u>
Air Transport Association, OAR-2003-0012-0755 p. 1-3
Association of Oil Pipelines, OAR-2003-0012-0609 p. 19-20
Colonial Pipeline Company, OAR-2003-0012-0694 p. 3
Environmental Defense, OAR-2003-0012-0821 p. 17
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 9
National Association of Convenience Stores/Society of Independent Gasoline Marketers of America, OAR-2003-0012-0635 p. 4-5
New England Fuel Institute, OAR-2003-0012-0712, 0713 p. 3
Chicago Public Hearing, A-2001-28, IV-D-06 [NACS/SIGMA p. 246]

Our Response:

In the process of developing the NPRM, refiners recommended the use of a marker as an effective means of restricting the sale of heating oil into the NRLM market. As discussed in section IV.D and V.E. of the preamble, we remain convinced that it is an appropriate and effective means of accomplishing this objective. We have also modified the provisions in the final rule in a way that addresses many of the concerns raised. We are no longer requiring that the marker be added to locomotive and marine diesel fuel after 2012. The commenters concern regarding use of the same marker in two different fuel grades. The Northeast/Mid-Atlantic Area provisions in today's rule also exempts those areas of the country which use the large majority of heating oil.

The marker finalized today will not provide visual evidence of its presence, the marker will only be added at the terminal at the same point where red dye is also added. In other words, the yellow marker should never be in fuel if red dye is not also present. As a result, it will not interfere with current field tests to detect contamination of jet fuels such as the "white bucket test".

Although Solvent Yellow #124 may impart a slight orange tint to red-dyed diesel fuel, this will not complicate the identification of the presence of the IRS red dye. Even so, as identified in the comments, the implementation of today's marker requirement for heating oil may be in conflict with IRS regulations at CFR 48.4082-1(b), which state that no dye other than the IRS-specified red dye must be present in untaxed diesel fuel. We have already begun discussions with IRS staff on this issue to determine what measures may be necessary to clarify that the addition of Solvent Yellow #124 to heating oil would not be in violation of IRS regulations. Through those discussions with the IRS, we have confirmed that the presence of Solvent Yellow #124 will not interfere with enforcement of their red dye requirement. The IRS has related that they are investigating a family of markers for potential use in addition to red dye under their diesel tax program which might be compatible with jet fuel. The IRS stated that the use of one of these markers as required under today's rule might result in a reduced burden on industry. Given the changes to our program in today's final rule, the marker provisions will not impose a significant burden. However, if the IRS program were to develop alternate markers that would be compatible with jet fuel we could consider amending today's final rule to adopt one such marker in place of SY-124.

10.1.2 Use of Solvent Yellow 124

10.1.2.1General

What Commenters Said:

AOPL and Octel-Starreon commented that the use of Solvent Yellow 124 will complicate enforcement since it must be measured using a laboratory procedure with hydrochloric acid, which will require additional equipment and training and will generate a small amount of hazardous waste. The commenters stated that a proven real-time online method to detect this marker does not exist and to make a cut between batches is a challenge in timing, equipment placement and power for the remote laboratory. API added that without visual evidence, the distribution system downstream of the yellow dye injection may be forced to test unmarked fuels, primarily jet fuel, to ensure that the product is free of yellow dye.

<u>Letters:</u>
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 13-14
Association of Oil Pipelines, OAR-2003-0012-0609 p. 18, 19-20
Octel-Starreon, OAR-2003-0012-0642 p. 1
New York Public Hearing, A-2001-28, IV-D-05 [AOPL p. 182-183]

Our Response:

The marker that we require under today's rule must be different from the red dye currently required by IRS and EPA and not interfere with the identification of red dye in distillate fuels. However, while the marker being finalized today will not provide visible evidence of its presence, if the marker is added at the terminal (as allowed by today's final rule) it will only be present when red dye is also present. The fact that heating oil and LM diesel fuel will be dyed red pursuant to IRS requirements before it leaves the terminal will enable jet fuel distributors to continue to use the "white bucket test" to detect the contamination of jet fuel with marked fuel.[46] Today's rule also contains a stand-alone requirement that fuel which is required to contain the marker must also contain visible evidence of red dye.

While visible dyes are most common, inexpensive, and easily detected, we believe that using a second visible dye in addition to that required by IRS for non-highway fuel would raise concerns regarding potential interferences with the IRS red dye.

While a marker with a simpler field test would be advantageous, there are many factors that go into the selection of a marker, as discussed in section IV and V.E of the preamble. On balance the advantages of yellow 124 outweigh the disadvantages raised in comment. The testing burden on industry itself should be minimal under the provisions of the final rule. Given the changes in where the marker is added and the significantly reduced scope of fuel that will need to be marked, we anticipate little if any need for industry to conduct field testing.

We continue to believe that such safety concerns are manageable here in the U.S. just as they are in Europe and that the small amount of waste generated through the process of identifying the presence of solvent yellow 124 can be handled along with other similar waste generated by the company conducting the test, and that the associated effort and costs will be negligible.

See also our response to Issue 10.1.1.2.

10.1.2.2Contamination Issues

What Commenters Said:

AOPL commented that there are several products handled in the pipeline transportation network that must not contain any unapproved additives, including Solvent Yellow 124. For example, aviation kerosene is distributed by numerous pipeline companies, and is critical to the supply chain of the nation's major airports and airlines. Since there is no means to detect the presence of Solvent Yellow 124 in aviation kerosene or any other product, there is a great deal of concern that these products could be delivered for use without the detection of this marker. The delivery of contaminated products could have an extremely detrimental impact on the airline industry including possible shutdown of a major airport if significant volumes of jet fuel were found to contain this additive after delivery into the tanks.

[46]To test for contamination, jet fuel marketers typically fill a white five gallon bucket with jet fuel. The presence of a pink tinge to the light straw colored jet fuel indicates that the fuel has been contaminated with red dyed fuel.

Letters:
Association of Oil Pipelines, OAR-2003-0012-0609 p. 18-19
New York Public Hearing, A-2001-28, IV-D-05 [AOPL p. 183]

A number of commenters commented that EPA's proposed selection of Solvent Yellow 124 may be premature. These commenters believed that EPA did not allowed the aviation community adequate time to evaluate the effects of Solvent Yellow 124 in jet fuel. The CRC Aviation Fuel Committee recently agreed to initiate a program to study the effects of Solvent Yellow 124 in jet fuel but acknowledged that EPA would need to provide additional time for study. The aviation community is extremely concerned about the possibility that jet fuel could be contaminated with Solvent Yellow 124. Detection of this additive is not within the current protocols for aviation fuel quality control, and it remains unclear whether detection limits by known test methods would prevent effects on aviation equipment. There has been previous contamination of jet fuel with red dye as required by the IRS in off-road fuel. This has been a frequent problem and years of intensive effort were required to determine the effects of trace contamination of red dye in jet fuel. Aviation turbines are expected to go thousands of hours before maintenance is required and trace levels of red dye have been shown to significantly reduce this interval. The same may be true of Solvent Yellow 124 and additional time is needed to evaluate its potential effect. ASTM provided additional documentation on the impact of dyes in aviation fuel including test results from GE and other related bulletins and emergency procedures (in the event that aviation fuel is contaminated) from Boeing, GE, Pratt & Whitney and Rolls Royce. ASTM further stated that EPA should delay implementation of the yellow dye requirement until the air transport industry and the FAA analyze the potential impact of the Solvent Yellow 124 dye marker on safety and operations.

Letters:
ASTM International, OAR-2003-0012-0601 p. 1, Att. A, B, C, D, E
Air Transport Association, OAR-2003-0012-0755 p. 1-3
Department of Defense, OAR-2003-0012-0617 p. 4-5
ExxonMobil, OAR-2003-0012-0616 p. 16
Federal Aviation Administration, OAR-2003-0012-0682 p. 1-2
New York Public Hearing, A-2001-28, IV-D-05 [1 public citizen (CP Henry) p. 137]

Chevron and ConocoPhillips commented that Solvent Yellow #124 has similar chemistry to the red dye used in non-road fuels today, so it would be expected to similarly contribute to deposit buildup in jet engine fuel nozzles. In addition, Solvent Yellow #124, unlike Red Dye #26, would not be visible in jet fuel at the concentrations expected to result from contamination, and it requires a complex, expensive laboratory test to detect its presence. Lastly, the commenters stated that EPA should work closely with the industry to identify a more acceptable dye or marker for heating fuel.

Letters:
Chevron, OAR-2003-0012-0782 p. 2-3
ConocoPhillips, OAR-2003-0012-0777 p. 3

AOPL and Williams Energy Partners commented that fuel marked with Solvent Yellow 124 may mix with other fuel products, causing contamination. The inadvertent marking of fuels with Solvent Yellow 124 is a concern, particularly for the reprocessed distillate market. Transmix facilities often located in close proximity to a pipeline are critical to the separation of the gasoline and distillate Transmix produced by pipelines into marketable products. Before the addition of the Solvent Yellow 124 marker, separated distillate would normally meet the specifications necessary to be sold into the nonroad locomotive and marine or heating oil market. However, the marker could taint the entire distillate batch so that while the sulfur content of the reprocessed distillate may be less than 500 ppm, it could only be sold into the more limited heating oil market between 2007 and 2010 and into the LM market after 2010. The commenters further noted that this unintended consequence should be resolved before the rule is finalized.

Letters:
Association of Oil Pipelines, OAR-2003-0012-0609 p. 19
Williams Energy Partners, OAR-2003-0012-0626 p. 3
Chicago Public Hearing, A-2001-28, IV-D-06 [AOPL p. 108]

The Air Transport Association commented that the yellow dye proposal, if approved, will pose a contamination risk and a potential safety risk. The use of red dye has led to contamination of multiple batches of jet fuel received at airports around the country, which has cause disruption of operations and significant expense to the airlines as they had to flush their tanks and systems of the contaminated fuel. The contamination risk with yellow dye may be even greater than with red dye since a significant portion of jet fuel is straw colored making the dye difficult to detect visually.

Letters:
Air Transport Association, OAR-2003-0012-0755 p. 2-3

Chevron and ConocoPhillips commented that if EPA decides that Solvent Yellow #124 will be the marker used in heating fuel, the point of addition of the marker should be moved from the refinery to terminals to keep this marker out of multi-product pipelines and reduce the risk that it will find its way into other products.

Letters:
Chevron, OAR-2003-0012-0782 p. 2-3
ConocoPhillips, OAR-2003-0012-0777 p. 3

Wyoming Refining commented that in certain pipelines, Solvent Yellow 124 is unlikely to cause contamination. The commenter further noted that there is little opportunity for Solvent Yellow 124 from heating oil to contaminate their jet fuel since their common carrier pipeline currently does not carry heating oil.

Letters:
Wyoming Refining Company, OAR-2003-0012-0651 p. 4-5

Our Response:

It is true that there is very little data on the effects of Solvent Yellow 124 on airplane engines, and that additional data would be useful. For instance, the contention that Solvent Yellow 124 would lead to deposits in fuel injection nozzles is not directly supported by data, though some might infer such problems based on experience with the red dye already used in nonroad fuel. Therefore, ASTM is expected to continue to work with CRC and the FAA in an effort to identify fuel markers that would be compatible for use in jet fuel. We will seriously consider initiating a review of the use of Solvent Yellow

#124 under toady's rule based on the findings of the CRC and the FAA, ongoing experience with the use of Solvent Yellow #124 in Europe, and future input from ASTM, IRS or other concerned parties.

However, despite the lack of data on the effects of Solvent Yellow #124 on airplane engines, we believe that concerns related to potential jet fuel contamination have been sufficiently addressed for us to finalize the selection of Solvent Yellow #124 as the required marker in today's rule. In particular, two changes to the provisions in our proposal related to the use of the marker should eliminate most of the potential sources of jet fuel contamination. We have replaced the proposed baseline approach with a designate-and-track approach that will be applied to high sulfur NRLM diesel fuel and heating oil. The designate-and-track approach allowed us to change the required point of marker addition from the refinery to the terminal. Adding the marker at the terminal rather than at the refinery gate will virtually eliminate the contamination concerns of Solvent Yellow #124 in jet fuel. This is supported by the fact that ASTM withdrew its request for a postponement in the regulation after we discussed with them our plans for the final rule (Letter from ASTM to EPA, January 19, 2004, OAR-2003-0012-0842).

In response to the concerns that the use of the marker would limit availability for the reprocessed distillate market, we also believe that this problem has been solved through the decision to finalize that the marker be added at the terminal. This means that the feed material that transmix processors receive from pipelines will not contain the marker. Hence, they will not typically need to cope with transmix containing the marker, and today's marker requirement is not expected to significantly alter their operations. There is little opportunity for marker contamination of fuels not required to contain the marker to occur at the terminal and further downstream. In the rare instances where this might occur, the fuel contaminated would likely also be a distillate fuel, and thus could be sold into the heating oil market without need for reprocessing.

10.1.2.3Potential Issues and Problems

What Commenters Said:

A number of commenters stated that many questions such as detection limits, fouling, compatibility with the current red dye are still unanswered, and adequate time to work through all of these issues by the end of the comment period is not available. The current use of hydrochloric acid in the yellow dye test method raises serious health concerns for field operators, and the ability to run this method may be restricted to laboratories with very limited or no field testing. API provided additional discussion and a detailed table summarizing the advantages and disadvantages of various fuel markers that are currently available and recommends that EPA continue to study and evaluate markers to make a final selection based on testing and impact concerns. API also attached documents related to the European Union's selection of Yellow Solvent 124, which provides some information that could help EPA's overall evaluation of this product.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 15
Association of Oil Pipelines, OAR-2003-0012-0609 p. 18-20
Colonial Pipeline Company, OAR-2003-0012-0694 p. 4
ConocoPhillips, OAR-2003-0012-0777 p. 3
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 9-10

National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 23-24

DoD commented that EPA should address several questions and potential problems regarding the use of Solvent Yellow 124 before allowing for its use as a fuel marker. EPA should provide additional information on what tests were used to determine the level of dye sufficient to color the product, whether numerous colors of heating oils were used or the number of the European Union. The EU uses this marker in gas oil and two grades of kerosene that are clear in color. The gas oil has a red dye and the yellow then makes it orange. The kerosenes are water white so the marker makes them yellow. In contrast, American heating oils run a full range of colors, being mostly darker in color. EPA should assess all the potential problems with yellow dye and should refrain from identifying it as a required marker until industry has an opportunity to recommend a marker that will not adversely impact aviation hardware.

Letters:
Department of Defense, OAR-2003-0012-0617 p. 4-5

UCM believes that its color additive effect to Solvent Red 164 should be thoroughly analyzed to ensure no interference with the Solvent Red 164 dosage level.

Letters:
United Color Manufacturing, Inc., OAR-2003-0012-0501 p. 2

UCM commented that EPA should examine issues regarding the use of Solvent Yellow 124 prior to implementation of the rule. They stated that the phase out of the patent coverage for Solvent Yellow 124 as well as any related supply and distribution issues should be confirmed by us prior to rule implementation so that no impediments are placed on other producers that hope to compete. UCM believes that given the projected date for marking, there appears to be sufficient time to address these issues.

Letters:
United Color Manufacturing, Inc., OAR-2003-0012-0501 p. 2

Our Response:

We evaluated many issues in the process of selecting Solvent Yellow 124 as the marker for use under today's rule, and determined that on balance its advantages outweighed its disadvantages in comparison to the alternatives. The primary reasons for our choice of Solvent Yellow 124 include:

1) There is considerable data and experience with it which indicates there are no significant issues with its use.
2) It is compatible with the existing red dye.
3) Test methods exist to quantify its concentration, even if diluted by a factor of 50 to 1.
4) It is reasonably inexpensive.
5) It can be produced and provided by a number of sources.

However, as previously stated, we intend to continue to evaluate the use of Solvent Yellow 124 under today's rule, and we may review this usage based on research and input from CRC, FAA, IRS, Europe, and ASTM.

Regarding concerns about the coloration of diesel fuel caused by Solvent Yellow 124, we note that our decision to use Solvent Yellow #124 was largely based on studies and findings from the EU's use of the marker. Studies have shown that Solvent Yellow 124 does not impart a strong color to diesel fuel when used at a concentration of 6 mg/l. Most often it is reportedly nearly invisible in distillate fuel given that the slight yellow color imparted is similar to the natural color of many distillate fuels.[47] This is not a disadvantage for our purposes, since we are not relying on visual inspection to determine its presence. See the response to 10.1.2.1 and 10.1.2.2 regarding potential heightened jet fuel contamination concerns because SY-124 can not be reliably detected by visual means alone.

Despite its name, we are using it as a chemical marker rather than as a visual dye. In the presence of red dye, Solvent Yellow #124 can impart a slight orange tinge to the fuel. However, it does not interfere with the visual identification of the presence of red dye, or the quantification of the concentration of red dye in distillate fuel. Through our discussions with the IRS, we have confirmed that the presence of SY-124 in diesel fuel at 6 mg/l will not interfere with enforcement of their red dye requirement.[48] Although, SY-124 may impart a slight orange tint to red-dyed diesel fuel, this will not complicate the identification of the presence of the IRS red dye. In fact, IRS has determined that the presence of SY-124 may even enhance enforcement of their fuel tax program.[49] The comment regarding potential heath and safety associated with the marker test procedure are addressed in section 10.1.2.4.

10.1.2.4Health and Safety

What Commenters Said:

ExxonMobil, IFTOA, and NEFI commented that current experience and testing is insufficient to confirm that the use of Solvent Yellow 124 is safe and appropriate for use in home heating oil. The commenters noted that we concluded that this marker will not harm residential heating equipment, based on Europe's experience with the same marker, but they raised concerns with this, commenting that Europe's experience is extremely limited (i.e. only one heating season). They concluded that a lack of evidence of the safety and efficacy of Solvent Yellow 124, the use of this marker should not be required in the final rule. NEFI also added that the use of this marker will lead to further increases in the cost of home heating oil.

<u>Letters:</u>
ExxonMobil, OAR-2003-0012-0616 p. 16
Independent Fuel Terminal Operators Association, OAR-2003-0012-0671, 0672 p. 3
New England Fuel Institute, OAR-2003-0012-0712, 0713 p. 3

[47]The color of distillate fuel can range from near water white to a dark blackish brown but is most frequently straw colored.

[48]Phone conversation between Carl Dalton, IRS and Rick Stiff, IRS, and Jeff Herzog and Paul Machiele, EPA, February 19, 2004.

[49]ibid

Octel-Starreon commented that we should further investigate the public health risk impact and market availability of Solvent Yellow 124, as well as potential alternatives. The commenter added that the chemical reagent based detection method requires the use of expensive, toxic, and hazardous chemicals and the proposal does not identify an alternative instrumental method. Octel-Starreon added that before introducing Solvent Yellow 124 into the system, EPA should work with industry and other groups to ensure that the use of this marker and the detection method will not adversely affect public health. The commenter also suggested that a multi-disciplinary working group be formed to select and implement the fuel marking system, which could be similar to the 1992-1994 introduction of the fiscal marker red 164.

Letters:
Octel-Starreon, OAR-2003-0012-0642 p. 1-2
New York Public Hearing, A-2001-28, IV-D-05 [Octel-Starreon p. 200]

A number of commenters (API, AOPL, Colonial, ConocoPhillips) believed that the current use of hydrochloric acid in the yellow dye test method raises serious health concerns for field operators, and the ability to run this method may be restricted to laboratories with very limited or no field testing.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 15
Association of Oil Pipelines, OAR-2003-0012-0609 p. 18-20
Colonial Pipeline Company, OAR-2003-0012-0694 p. 4
ConocoPhillips, OAR-2003-0012-0777 p. 3
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 9-10
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 23-24

Our Response:

Commenters provided no data or information to support assertions that SY-124 provided any safety concern. Furthermore, no evidence was provided that the hazardous chemicals and hazardous waste from the testing posed unreasonable safety risks. Test methods like these are not uncommon in the industry today. Furthermore, as discussed above, we anticipate little need for industry to perform the chemical testing under the provisions of the final rule. For those parties that do need to conduct testing for the marker, the European experience regarding testing for SY-124 and the significant lead-time before the implementation of today's marker requirement should ensure the ready availability of field test equipment to test for SY-124.[50]

Based on the European experience with Solvent Yellow 124, we do not expect that there would be concerns regarding the compatibility of Solvent Yellow 124 in the U.S. fuel distribution system. Our evaluation of the process conducted by the EU in selecting Solvent Yellow 124 for use in the EU convinced us that this was also the most appropriate marker to propose for use in under today's

[50]Memorandum to the docket entitled "Use of a Visible Spectrometer Based Test Method in Detecting the Presence and Determining the Concentration of Solvent Yellow 124 in Diesel Fuel"

program.[51] The EU's experience with the use of solvent yellow 124, and the evaluation process it underwent prior to selection by the EU, provides strong support regarding the compatibility of SY 124 in the U.S. fuel distribution system, and for use in motor vehicle engines and other equipment such as in residential furnaces.

We believe that concerns regarding the potential health impacts from the use of Solvent Yellow #124 do not present sufficient cause to delay finalization of the requirement for its use under today's rule. The EU intends to review the use of Solvent yellow 124 after December 2005, but may undertake the review earlier if any health and safety or environmental concerns about its use are raised, and we intend to keep abreast of such activities. In addition, we may initiate our own review of the use of solvent yellow 124 depending on the European Union's findings, or other relevant information.

There will be nearly four years of accumulated field experience with the use of Solvent Yellow #124 in Europe at the time of the review by the EU and nearly 5 years by the implementation of the marker requirement under today's rule. This will provide ample time for any potential unidentified issues with Solvent Yellow #124 to be identified, and for us to choose a different marker if warranted.

See also our response to Issue 10.1.2.3 for a discussion of the reasons that we chose Solvent Yellow 124 over the alternatives.

10.1.2.5Availability

What Commenters Said:

Octel-Starreon commented that Solvent Yellow 124 is not readily available in the market. Even though there are a number of manufacturers that can make the dye, it is protected by U.S. patent 4904765. This BASF patent has caused a tremendous amount of problems in Europe. EPA should address issues that may arise due to BASF's exclusive position in distributing this fuel marker. In addition, Octel-Starreon commented that we should ensure that a dye is selected that is free from patent restrictions and has been successfully used for regulated fuel marking purposes, such as Leucoquinizarin (CAS number 17648-03-2).

<u>Letters:</u>
Octel-Starreon, OAR-2003-0012-0642 p. 1-2
New York Public Hearing, A-2001-28, IV-D-05 [Octel-Starreon p. 198-200]

Our Response:

The patent situation for SY-124 is not a significant issue with respect to its selection for use under today's program. While BASF holds the patent, the additive is able to be produced by a number of

[51] The European Union marker legislation, 2001/574/EC, document C(2001) 1728, was published in the European Council Official Journal, L203 28.072001. Opinion on Selection of a Community-wide Mineral Oils Marking System, ("Euromarker"), European Union Scientific Committee for Toxicity, Ecotoxicity and the Environment plenary meeting, September 28, 1999.

different companies under licensing agreements with BASF. Even more importantly, the proprietary rights related to Solvent Yellow #124 expire several months after the implementation of the marker requirements finalized in today's rule. Therefore, we do not expect that the current proprietary rights regarding Solvent Yellow #124 are a significant concern.[52]

10.1.2.6Alternatives to Solvent Yellow 124

What Commenters Said:

Isotag commented that EPA should consider alternatives to Solvent Yellow 124, since there are alternatives to Solvent Yellow 124 that are more cost-effective, easier to use and field test, and pose less of a threat to jet fuel via contamination. According to the proposed rule, the marker system will cost 0.16 to 0.20 cents per gallon, which is high for any marker program. An Isotag marker program would cost approximately 0.005 to 0.01 cents per gallon, which would vary depending on the detection/dilution limit specifications. With respect to field testing, current tests in Europe for Solvent Yellow 124 requires the addition of acidic chemical to identify presence, which create hazardous waste. Isotag marker systems do not require any additional chemical or additives and when complete, the fuel can be reintroduced to the tank it was extracted from. In addition, Isotag tests are not subjective and only require a light handheld instrument that provides quantitative results in 1 to 2 seconds. With respect to jet fuel contamination, Isotag markers have passed initial tests intended to screen out potential negative contaminants. Isotag provided additional information and supporting documentation regarding available technologies in a paper entitled "Invisible Fuel Marking Systems: Alternatives to Color Dyes?"

Letters:
Isotag, OAR-2003-0012-0666, 0824 p. 1, Att. 1-14

United Color Manufacturing commented that it produces a number of products that are candidates for marking heating oil under the Unimark name. One product is colorless in nature and has been used over fifteen years in fuel applications including diesel fuel in various parts of the world. Patent coverage is not an issue and its presence can also be determined through a simple qualitative field test and a quantitative lab test. It has the added advantage of being able to be prepared from raw materials produced domestically and this eliminates possible import supply problems. Alternates are available which also offer little or no color in appearance.

Letters:
United Color Manufacturing, Inc., OAR-2003-0012-0501 p. 2

ExxonMobil commented that there are a number of alternative marking mechanisms that could be considered but additional time may be necessary to ensure that the selected marker is the proper choice. Non-radioactive isotopic molecular markers are available that are more likely to avoid aviation fuel contamination concerns. However, such markers are more expensive, and cannot be read as readily in the field.

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[52] The patent and related information for Solvent Yellow 124 is available from the patent office website at: http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO1&Sect2=HITOFF&d=PALL&p=1&u=/netahtml/srchnum.htm&r=1&f=G&l=50&s1=4904765.WKU.&OS=PN/4904765&RS=PN/4904765

Letters:
ExxonMobil, OAR-2003-0012-0616 p. 16-17

Our Response:

There are a number of alternative dyes and markers that could be used instead of Solvent Yellow 124. Visible dyes are most common, are inexpensive, and are easily detected. However, using a second dye in addition to the red dye required by IRS in all non-highway fuel for segregation of heating oil (or 500 ppm sulfur LM diesel fuel produced by refiners or importers from 2010 through 2012) based on visual identification raises certain challenges. The marker that we require must be different from the red dye currently required by IRS and EPA and not interfere with the identification of red dye in distillate fuels. Invisible markers are beginning to see more use in branded fuels and are somewhat more expensive than visible markers. Such markers are detected either by the addition of a chemical reagent or by their fluorescence when subjected to near-infra-red or ultraviolet light. Some chemical-based detection methods are suitable for use in the field. Others must be conducted in the laboratory due to the complexity of the detection process or concerns regarding the toxicity of the reagents used to reveal the presence of the marker. Near-infra-red and ultra-violet flourescent markers can be easily detected in the field using a small device and after brief training of the operator. There are also more exotic markers available such as those based on immunoassay, and isotopic or molecular enhancement. Such markers typically need to be detected by laboratory analysis.

We met and corresponded with numerous and diverse parties to evaluate the concerns expressed regarding the use of SY-124, and to determine whether it might be more appropriate to specify a different marker. These parties include IRS, FAA, ASTM, CRC, various marker/dye manufacturers, European distributors of fuels containing the Euromarker, marker suppliers, and members of all segments in the U.S. fuel distribution system. In particular, Isotag markers may look promising in some respects, but they also raised a number of unknowns, including patent issues. On balance, we determined that the advantages of Solvent Yellow 124 outweighed its disadvantages in comparison to the alternatives. In addition to the considerable amount of data and experience with it which indicates there are no significant issues with its use, it is also compatible with the existing red dye, is reasonably inexpensive, and can be produced and provided by a number of sources. Finally, test methods exist to quantify its concentration, even if diluted by a factor of 50 to 1.

Since the proposal we have obtained more accurate information which indicates that the current cost of bulk quantities of Solvent Yellow 124 is approximately 0.03 cents per gallon of treated fuel (see Section VI of the preamble). Based on conversations with various marker manufacturers, this cost is comparable to, or less than, other fuel markers.

As stated above, we will seriously consider evaluating other markers for use in place of Solvent Yellow 124 based on future input from CRC, ASTM, IRS, FAA, and other interested parties, as well as the European experience with the use of SY-124.

10.1.2.7Other

What Commenters Said:

Countrymark and Wyoming Refining commented that certain provisions associated with the use of Solvent Yellow 124 should be clarified. Countrymark commented that, in regards to the provisions associated with the use of Solvent Yellow 124, we should clarify whether: 1) the yellow dye will be sufficiently visible in cases where a product has been previously dyed red and is subsequently downgraded to heating oil; 2) all product sold as heating oil requires the addition of yellow dye (i.e. can product dyed red be sold as heating oil?); and 3) the regulation allows for flexibility to inject yellow dye at either the refinery or a particular terminal. Also, Wyoming Refining commented that the definition of "V-marked" in the proposed Section 80.534(b)(3) should be clarified since proposed section 80.510(c) as referenced in the definition, does not mention Solvent Yellow 124.

Letters:
Countrymark Cooperative, OAR-2003-0012-0602 p. 2
Wyoming Refining Company, OAR-2003-0012-0651 p. 5

UCM commented that CFR Section 48.4082-1(b) specifically states that Solvent Red 164 and no other dye, will be used in untaxed diesel- the implication is that Solvent Yellow 124 would be in violation of the IRS regulation.

Letters:
United Color Manufacturing, Inc., OAR-2003-0012-0501 p. 2

Our Response:

The yellow marker may be somewhat visible in red-dyed diesel fuel (as it may impart a slight orange tint to this fuel), but it is largely undetectable by the naked eye. Though the marker being finalized today is not intended to provide visual evidence of its presence, the marker will only be added at the terminal at the same point where red dye is also added. In other words, yellow marker should never be in fuel if red dye is not also present. As a result, the “white bucket test” which is currently used to detect contamination of jet fuel with red dyed fuel, will also reveal contamination of jet fuel with fuel containing SY-124.

With the exception of the Northeast/Mid-Atlantic Area and Alaska (see Chapter IV.D of the preamble for more discussion on this), all fuel designated as heating oil (beginning 2007) and 500 ppm diesel fuel produced at a refinery or imported (from 2010 through 2012) will be required to have the Solvent Yellow 124 fuel marker prior to delivery at end-use (i.e. as it leaves the terminal). However, fuel not designated as heating oil may still be sold into heating oil applications and does not need to contain the marker. Locomotive and marine diesel fuel generated from segregated interface or produced from transmix is not required to contain the marker.

The program that we are finalizing today allows addition of the marker at the refinery gate, but we do not anticipate this practice occurring except for over the refinery rack. Rather, we anticipate that the marker will be injected at the terminal.

Regarding Wyoming Refining's comment that proposed section 80.510(c) does not mention Solvent Yellow 124, we note that this particular provision has become moot since we have replaced the baseline approach with the designate-and-track approach.

Through our discussions with the IRS, we have confirmed that the presence of Solvent Yellow #124 will not interfere with enforcement of the red dye requirement. Also, the fact that the marker may impart an orange tint to dyed diesel fuel will not complicate the identification of the presence of the IRS red dye (see Section 10.1.2.5). However, as noted by UCM's comments, the implementation of today's marker requirement may arguably be in conflict with IRS regulations at CFR 48.4082-1(b), which state that no dye other than the IRS-specified red dye must be present in untaxed diesel fuel. IRS is evaluating what actions might be necessary to clarify that the addition of SY-124 to heating oil would not violate IRS regulations.

See also our response to Issue 10.1.1.2.

10.2 Fuel Sulfur Testing and Sampling Requirements

10.2.1 Testing Requirements

10.2.1.1Supports a Performance-based Test Method Approach, but Provides Suggestions for Improvement

What Commenters Said:

API, AOPL, BP, Exxon, Marathon, NPRA, and Tesoro commented that industry has long advocated a performance-based approach toward qualification of test methods and EPA's proposed approach should be maintained to allow regulated parties to adopt a performance based test method approach for diesel fuel subject to the 15 ppm and 500 ppm sulfur standards. ASTM recently evaluated four sulfur test methods to determine their repeatability and reproducibility. This involved an evaluation of the reproducibility of the test methods between different labs, which is particularly important for refinery certification and EPA enforcement purposes. Each of the four methods has its own level of repeatability, which differed between each of the labs, and the industry is currently working to identify testing improvements to reduce uncertainty and increase precision. NPRA and BP provided three recommendations regarding the sulfur test methods: 1) EPA's lab should use the most accurate and precise testing method available, 2) EPA's lab should use the ASTM cross check program so that any bias can be reduced or eliminated, and 3) EPA should establish a downstream enforcement allowance that is consistent with the level of precision of the lab methods in use. API also recommended that EPA participate in the ASTM Interlaboratory Crosscheck Program set to commence on January 1, 2004. BP expressed support for EPA's use of the official repeatability to be published in the ASTM Round Robin Research Report for ASTM D 3120 -- i.e., 1.33 ppm -- as the basis for the performance-based test method criteria and also expresses support for ASTM D 6299-02, "Standard Practice for Applying Statistical Quality Assurance Techniques to Evaluate Analytical Measurement System Performance" since it is important that a laboratory have quality control procedures in place to demonstrate that an approved test method remains in control.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 9-12
Association of Oil Pipelines, OAR-2003-0012-0609 p. 22
BP, OAR-2003-0012-0649 p. 5-6
ExxonMobil, OAR-2003-0012-0616 p. 3, 9-10

Marathon Ashland, OAR-2003-0012-0826, 0827 p. 13-16
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 22
Tesoro, OAR-2003-0012-0662 p. 2
New York Public Hearing, A-2001-28, IV-D-05 [API p. 21; NPRA p. 84]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [API p. 44]
Chicago Public Hearing, A-2001-28, IV-D-06 [API p. 88; BP p. 172-174; NPRA p. 20]

API, Flint Hills Resources, Marathon, and NPRA commented that EPA's proposed approach with respect to the requirements for precision of the chosen test method(s) and the proposed "20 repeat sulfur tests over a minimum of 4 days" requirement, are reasonable. FHR noted that the 20 results must be a series of test with a sequential record of the analyses and no omissions and requested that EPA clarify what constitutes a "series of test."

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 10
Flint Hills Resources, OAR-2003-0012-0667 p. 8
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 14
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 18-19

API, BP, Marathon, and NPRA commented that EPA's proposed performance-based test method approach for accuracy is reasonable. However, it appears that the accepted reference value (ARV) of the standards does not account for any uncertainty, which would be in conflict with the fact that all commercially available standards have an uncertainty associated with the certified value. EPA should address how it has taken into account the matter of uncertainty in the certified value or ARV for the standard material and should also address the associated question of what maximum value in the uncertainty associated with the ARV is allowable for the accuracy criterion being proposed by EPA. Information on the maximum value is important for laboratories as they make decisions on which standard materials to purchase for the purpose of qualifying the test method per the accuracy criterion.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 10-11
BP, OAR-2003-0012-0649 p. 5
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 14-15
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 19-20

API, Marathon, and NPRA commented that EPA's proposed requirements for the submittal of information necessary for approval of the VCSB test methods are reasonable but should also include the dates on which each piece of data were obtained. In addition, fuel samples used for precision and accuracy demonstrations should be retained for the length of EPA's review period (i.e. 90 days). These requirements, the commenters stated, should also apply to non-VCSB methods.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 11
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 15
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 20-21

API, Marathon, and NPRA commented that EPA's approval for non-VCSB test methods should not automatically lapse after 5 years with no option for reconsideration and renewal. Five years experience with the method "certifying" diesel batches for sulfur concentration suggests that the method is accurate, precise and robust. A five year period is a reasonable amount of time for an instrument vendor to obtain approval from a consensus body of a new and/or improved test method. However, for refiners, it is possible that they may not wish to share the method with others in the industry if the method provides a competitive advantage that exceeds the income resulting from the licensing of the instrument technology. EPA should allow for a process whereby a laboratory having an approved non-VCSB test method could apply for re-approval at the end of the first, five year period.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 11
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 15
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 20-21

API, Marathon, and NPRA further commented that the proposed quality assurance procedure requirements specified in 80.585(d) are reasonable. However, the required retention period for samples of tested batches of diesel fuel should be specified (e.g. 30 days), rather than the more vague statement of "at least as long as the period between quality control material or check standard testing occasions."

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 11-12
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 15-16
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 21-22

Flint Hills Resources commented that EPA should name a designated sulfur method for both the 15 ppm and 500 ppm diesel fuel and should allow for the performance based approach to serve as the alternative. Under this scenario, the rule would provide simplicity and consistency by treating both fuel types the same and eliminate the need to correlate to a designated method for 500 ppm fuel as detailed in Section 80.580(ii)(A). This approach provides additional flexibility by giving an alternative to those who do not wish to participate in the performance-based test program for 15 ppm diesel fuel.

Letters:
Flint Hills Resources, OAR-2003-0012-0667 p. 8

Wyoming Refining Company commented that EPA should maintain proposed Sections 80.584 and 50.585 that allow a refiner to certify any method for analyzing on and off road diesel sulfur if that method passes a prescribed precision and accuracy demonstration performed by the laboratory or refiner. EPA should adopt the same approach for Tier 2 gasoline sulfur analyses.

Letters:
Wyoming Refining Company, OAR-2003-0012-0651 p. 4

Sunoco commented that a performance based test method should be maintained, but without the proposal to require "non-standard" or proprietary test methods to receive industry acceptance within five years; the only criterion governing use of such methodologies should be whether the method satisfies EPA's performance requirements.

Letters:
Sunoco, OAR-2003-0012-0509 p. 2

The New York Department of Environmental Conservation commented that accurate and repeatable sulfur test methods are necessary to ensure that the environmental benefits of the on-highway and nonroad diesel rules are attained in the field, and to protect the investments of owners of aftertreatment equipped diesel engines. EPA has chosen not to designate any test method for sulfur concentration in ultra low sulfur diesel fuel, instead detailing the performance standards that any test method must meet. However, even though the proposed performance based approach has its merits, it is better suited to the evaluation of alternatives to an EPA designated sulfur test method than as a substitute. EPA should designate one or more test methods that are known to meet the proposed performance standard, and should use the performance standard to evaluate alternative methods that are proposed in the future.

Letters:
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 5

Our Response:

Regarding the NPRA and BP recommendations for sulfur test methods, we will take these recommendations under advisement as we go forward. Generally, we will take the necessary steps to best ensure the enforcement of our standards. Also, we have been and are actively working with ASTM in the Interlaboratory Crosscheck Program including ways to improve its usefulness. We anticipate that the reproducibility of sulfur test methods is likely to improve to two ppm (consistent with our 2 ppm downstream tolerance) or even less by the time the 15 ppm sulfur standard for highway diesel fuel is implemented – four years before implementation date of the 15 ppm standard for NR diesel fuel. With the 2 ppm downstream tolerance provision finalized in today's rule, we anticipate that refiners will be able to produce diesel fuel with an average sulfur level of approximately 7-8 ppm and some contamination could occur throughout the distribution system, without fear of causing a downstream violation due solely to test variability. As test methods improve in the future, we will reevaluate whether two ppm is the appropriate allowance for purposes of this compliance provision.

For the final rule, we are specifying that the precision of a given sulfur test method under the performance-based approach must be demonstrated by a laboratory facility by performing 20 repeat tests over 20 days on samples taken from a homogeneous supply of a commercially available diesel fuel. Based on the comments we received on this issue, we are also clarifying that the test results must be a sequential record of the analyses with no omissions.

The performance-based approach to establishing the accuracy of a test method includes the use of an Accepted Reference Value (ARV) which, as some commenters point out, will include some inherent uncertainty. However, we are requiring the ARV to be based on gravimetric methods with the intention of minimizing that uncertainty. As a result, the uncertainty in the ARV is expected to be considerably lower than the uncertainty in the sulfur test method whose accuracy is being evaluated. In addition, parties entering into the process for approving sulfur test methods will have an incentive to use those standard reference materials with the lowest possible uncertainty, and this will place competitive pressure on suppliers of such materials to meet increased demand for precise ARVs. We therefore continue to believe that the accuracy criteria of 0.54ppm and 7.26ppm for 15ppm and 500ppm standard diesel fuel, respectively, are sufficiently wide to account for uncertainty inherent in ARVs.

As described in the preamble, while we proposed a 30 day sample retention period, commenters stated that the sample retention period for fuel samples that are used for precision and accuracy demonstrations should be equivalent to the length of EPA's review period (i.e., 90 days). We agree with the commenters and are thus finalizing a 90 day sample retention period in today's rule. This sample retention requirement also applies to non-VCSB methods.

We did not explicitly require the date of every measurement to be included when parties submit their reports to the EPA containing their showing of precision and accuracy for a specific test method. Due to the concern that parties requesting approval for a specific test method could manipulate the process and reduce overall uncertainty by, for instance, taking nineteen measurements on day one and a single measurement on day twenty, we have created an additional requirement that the 20 measurements must be taken in such a way that no fewer than 24 hours have elapsed between individual measurements. The proposed criterion that the measurements must be taken over a period of 20 days has been dropped in favor of this more robust provision guaranteeing an even distribution of measurements over time. In order to verify that this is indeed happening, we are also requiring that reports to the EPA requesting approval for a sulfur test method also include the date of every measurement.

As described in the preamble, federal government and EPA policy is to use standards developed by voluntary consensus bodies when available. Such standards foster consistency in regulatory requirements, take advantage of the collective industry wisdom and wide-spread technical evaluation required before a test method is approved by a consensus body, and take advantage of the ongoing oversight and evaluation of a test method by the consensus body that results from wide-spread use of an approved method e.g., the ongoing round-robin type analysis and typical annual updating of the method by the consensus body. These goals are not met where the Agency allows use of a non-consensus body test method in perpetuity. Nevertheless, EPA believes it is appropriate to allow limited use of a proprietary test method for a limited time, even though the significant advantages of consensus test methods are absent, because EPA can evaluate the initial quality of a method and a company may have invested significant resources in developing a method. However, if after a reasonable time a test method fails to gain consensus body approval, EPA believes approval of the method should be withdrawn because of the absence of ongoing consensus oversight. Accordingly, a non-VCSB method will cease to be qualified five years from the date of its original approval by EPA in the absence of VCSB approval.

As described in the proposal, the highway diesel fuel rule announced the Agency's intention to adopt a performance-based test method approach in the future, as well as our intention to continue working with the industry to develop and improve sulfur test methods. We deem the performance-based approach to sulfur test method approval to be a more robust mechanism for ensuring that the standards are being met than simply establishing a designated test method. Today's action adopts such a performance-based test method approach for both highway and NRLM diesel fuel subject to the 15 ppm and 500 ppm sulfur standards. In addition, the current approach for measuring the sulfur content of diesel fuel subject to the 500 ppm sulfur standard, i.e., using the designated sulfur test method or one of the alternative test methods with correlation will remain applicable. We are not extending the performance-based approach to Tier 2 gasoline sulfur in today's final rule because this parameter will be addressed as part of a later rulemaking applying the approach to several parameters.

10.2.1.2EPA Should Provide a Mechanism for Refineries to Obtain a Diesel In-line Blending Waiver

What Commenters Said:

API, ConocoPhillips, Marathon, and NPRA commented that in Section 80.581, EPA has proposed requiring test results prior to shipment for diesel subject to the 15 ppm standards. Currently, there are refineries that in-line blend diesel to the distribution system just as they do with gasoline. EPA should provide a mechanism for these refineries to obtain a diesel in-line blending waiver through a process similar to that for gasoline, which is outlined in 40 CFR 80.65. This would prevent refineries in this situation from having to build additional tankage to contain the diesel product while obtaining the test results.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 21
ConocoPhillips, OAR-2003-0012-0777 p. 5
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 16
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 22-23

Our Response:

We have determined that it is appropriate to establish criteria for obtaining a waiver for in-line blending. As described in the preamble, the criteria will ensure that the 15ppm standard will not be compromised by the in-line blending system. See section V.D of the preamble for more information.

10.2.1.3EPA Should Support the Development of a Reliable Field Test

What Commenters Said:

AOPL commented that pipelines need a reliable and durable field test, which has not yet been developed. Pipelines need to be able to determine quickly and in a very low-tech manner, whether a batch or tank is on spec or off spec. In the case of 15 ppm diesel fuel, the pipeline would not need to know the exact sulfur level, only that the tested batch is below the maximum sulfur level allowed. AOPL further stated that without this type of test, pipelines may need to halt deliveries and delay movements until laboratory results can be obtained, which is a multi-day process.

Letters:
Association of Oil Pipelines, OAR-2003-0012-0609 p. 22-23

Our Response:

The liability provisions applicable to parties downstream of the refinery may indeed necessitate an independent evaluation of the sulfur content of diesel fuel that they hold or transport. However, this is an issue that industry is best positioned to resolve, as it is specific to the particular needs of various companies. It is our understanding that this is first and foremost a highway program issue beginning in 2006. As such, whether a new sulfur field test method is developed, or whether some other procedures are developed to provide assurance that the applicable sulfur standards are being met, we believe that this issue will be resolved well before the 15ppm standard for NRLM takes effect.

10.3 Compliance

10.3.1 Special Fuel Provisions and Exemptions

10.3.1.1Fuel Used in Military Vehicles

What Commenters Said:

DoD commented that we should reconsider our determination that JP-8/JP-5 falls within the definition of diesel fuel under the existing fuel regulations. EPA has proposed to treat distillates used in military applications in the same manner as they are treated under the recent highway diesel rule. However, previously, in 1995, EPA had determined that the use of JP-8 in military vehicles was not a violation of the then-existing fuel regulations. DoD must use the exemptions allowed in 40 CFR 89.908 and 40 CFR 1068.25 to exempt tactical nonroad engines that would otherwise have to meet the Tier 4 emission standards, which solves the problem of being able to use the single battlefield fuel JP-8 when deployed overseas. DoD has directed that rapid deployment land forces convert to use of JP-8 at U.S. home bases as well to support the DoD requirement for a single battlefield fuel, which avoids the time, cost, and maintenance problems associated with switching fuels. JP-8 had not been previously classified in 1995 as a diesel fuel on the basis of its physical characteristics and pattern of use (see letter from Mary Smith, Director Field Operations and Support Division to Ms. Sherri Goodman, Deputy Under Secretary of Defense (Environmental Security), dated May 1, 1995) and these same conditions still apply today. Therefore, EPA should reconsider its determination that JP-8 and JP-5 fall within the definition of diesel fuel and should reinstate the 1995 definition.

Letters:
Department of Defense, OAR-2003-0012-0617 p. 5-6

Environmental Defense commented that we should not provide any exemptions from the 15 ppm standard for special fuels.

Letters:
Department of Defense, OAR-2003-0012-0617 p. 6-7
Environmental Defense, OAR-2003-0012-0821 p. 17

DoD commented that the proposed rule may have an adverse impact on the quality and availability of military fuels, especially the aviation fuels JP-5 and JP-8. Given the potential reduction in refining capacity generally and in the number of refineries that produce military-specific fuels, some military fuel requirements may be marginalized out of the market. It is already difficult to obtain a sufficient supply of military JP-5 fuel that meets the flash point requirement for shipboard safety and the proposed rule may force some refiners to stop manufacturing this unique fuel, which would reduce supply, increase cost, and adversely impact readiness.

DoD also stated that increased hydroprocessing severity and other refinery process modifications necessary to meet the standard will impact chemical and physical characteristics in the current specifications. DoD and the industry have experienced an increase in jet fuel thermal stability problems, especially on the west coast. DoD is increasingly seeing a decline in jet fuel stability, which may be exacerbated by the proposed rule.

Letters:
Department of Defense, OAR-2003-0012-0617 p. 2-3

DoD commented that refiners currently blending more than 10 percent light cycle oil (LCO) into their 500 ppm diesel may shift some LCO into off-highway distillate fuels, such as marine and locomotive fuels, which would adversely affect the quality of the fuels used by the military, such as the Naval Distillate fuel (F-76). DoD has already experienced quality problems with LCO component streams that were not adequately hydrotreated, causing a highly unstable finished product. EPA should evaluate the impacts of the proposed diesel changes on kerosene distilled products and should develop solutions to ensure the needed refining capacity for national security.

Letters:
Department of Defense, OAR-2003-0012-0617 p. 2-3

Lastly, DoD stated that the proposed rule may adversely affect the pipeline system to the point where it is unable to accommodate the transportation of military fuels. DoD relies on pipeline shipments as the most cost-effective and viable means of transporting its fuels. The reduced flexibility of the distribution system, especially during the transition period from 500 ppm to 15 ppm sulfur diesel fuels, may present a problem with respect to the shipment of specialty fuels or segregated shipments of fuel through pipelines that require separate tankage, such as DoD fuels (F-76, JP-5, and JP-8), which are not fungible. EPA should fully evaluate the impact of the proposed rule on the distribution system and should work with the appropriate regulatory authorities to ensure that open pipelines access to all users is maintained throughout the transition to ultra-low sulfur fuels.

Letters:
Department of Defense, OAR-2003-0012-0617 p. 3-4

Our Response:

As discussed in section IV.A.1 of the preamble to the final rule, the sulfur standards in today's rule generally cover all the diesel fuel that is intended for use in or used in NRLM applications that is not already covered by the standards for highway diesel fuel. For the purposes of this preamble, this fuel is defined primarily by the type of engine which it is used to power: land-based nonroad, locomotive, and marine diesel engines. Section IV.A.1 also describes several types of petroleum distillate that are not covered by the sulfur standards promulgated today, including jet fuel and heating oil, provided they are not used in NRLM engines. The following paragraphs discuss several provisions and exemptions for NRLM fuel that will apply in special circumstances.

We believe that it is inappropriate to adopt the approach suggested by DoD. First, military fuels are readily used for non-military applications. We are aware of a number of cases of the misuse of aviation turbine fuel in highway engines in the past. Hence, the potential for misuse of JP-8 or similar fuels in nonroad equipment where no national security exemption or need exists. Second, finalizing the provisions as proposed would apply the NRLM fuel standards to military applications where it is possible to achieve the environmental benefit without compromising national security needs.

Under today's rule, NRLM diesel fuel used in military applications is treated in the same manner as under the recent highway diesel rule. Refiners are not required to produce these fuels to the NRLM standards. However, at the same time, their use is limited only to certain military applications. NRLM diesel fuel is defined so that JP-5, JP-8, F76, and any other military fuel that is used or intended for use in NRLM diesel engines or equipment is initially subject to all of the requirements applicable to NRLM diesel fuel. However, today's rule also exempts these military fuels from the diesel fuel sulfur content and other requirements in certain circumstances. First, these fuels are exempt if they are used in tactical military motor vehicles or nonroad engines, or equipment that have a national security exemption from the vehicle or engine emissions standards. Due to national security considerations, EPA's existing regulations allow the military to request and receive national security exemptions (NSE) for their motor vehicles and NRLM diesel engines and equipment from emissions regulations if the operational requirements for such vehicles, engines, or equipment warrant such an exemption. This final rule does not change these provisions. Fuel used in these applications is exempt. Second, these fuels are also exempt if they are used in tactical military vehicles, engines, or equipment 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), these vehicles, engines, and equipment need to be fueled on the same fuel as vehicles, engines, or equipment with a national security exemption. Use of JP-5, JP-8, F76, or any other fuel not meeting NRLM diesel fuel standards in a motor vehicle or NRLM diesel engine or equipment other than the those described above is prohibited under today's rule.

EPA and the Department of Defense have developed a process to address the tactical vehicles, engines, and equipment covered by the diesel fuel exemption and are discussing whether changes to it might be appropriate. Based on data provided by the Department of Defense to date in the context of implementing a similar exemption provision in the highway program, EPA believes that providing an exemption for military fuel used in tactical nonroad engines and equipment will not have any significant environmental impact.

DoD cited a 1995 letter from EPA which stated that there was insufficient reason to conclude that JP-8 is commonly and commercially known as diesel fuel under the then applicable definition of motor vehicle diesel fuel. Since the time of this letter, EPA has become aware of a substantial number of cases of the misuse of aviation turbine fuel in highway engines. The potential for misuse of JP-8 or similar fuels in NRLM equipment where no national security exemption exists would remain. To ensure that NRLM equipment is properly fueled with low sulfur fuel, the definition of NRLM diesel fuel has been written to encompass all diesel or other distillate fuels used or intended for use in NRLM engines, which would include JP-8 and JP-5. Furthermore, the provisions in today's rule allow vehicles, engines, and equipment to be fueled with military specification fuels that are exempt from the sulfur standards when needed for national security. We believe that this provides DoD with the needed flexibility to meet its goals of keeping vehicles, engines, and equipment ready for quick deployment overseas.

10.3.1.2Aviation Fuels

What Commenters Said:

The New York Department of Environmental Conservation commented that EPA should promulgate aviation fuel sulfur standards.

Letters:
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 8

Our Response:

Sulfur standards for aviation fuel are outside the scope of today's final rule. In addition, there are procedural and practical reasons why EPA has not established a more stringent sulfur requirement for jet fuel in the past. The procedural reason is that while the Clean Air Act requires EPA to determine the aircraft emissions that endanger public health and welfare, EPA is not the regulatory setting Agency for aircraft fuel. In fact, the Federal Aviation Administration (FAA), rather than EPA, has the authority to prescribe standards for aircraft fuel to control or eliminate aircraft emissions (49 U.S.C. section 44714). Furthermore, to meet the currently proposed emission standards or those standards expected to be adopted in the near future, reductions in aircraft fuel sulfur content are not necessary. To control aircraft emissions in the future, EPA plans to consult with FAA on such matters.

The practical reason concerns the relatively low sulfur levels of jet fuel today. Currently, ASTM limits the sulfur content of jet fuel to 0.3 percent, which is consistent with the test fuel specifications in EPA and FAA regulations for aircraft engine emission standards (40 CFR, part 87 and 14 CFR, part 34 respectively). However, the in-use sulfur levels are actually significantly lower than the current standard. According to the 1999 report issued by the Intergovernmental Panel on Climate Change (IPCC), entitled, *Aviation and the Global Atmosphere*, the average sulfur content of jet fuel around the world likely ranges from 0.04 to 0.06 mass percent. Data obtained on jet fuel sulfur levels here in the U.S. shows that jet fuel averages about 0.055 mass percent. When compared to the current sulfur levels of high sulfur diesel fuel pool (~0.3 percent), jet fuel sulfur levels are almost an order-of-magnitude lower. Thus, sulfur control of jet fuel would achieve only a fraction of the sulfate reductions of controlling today's high sulfur distillate.

10.3.1.3Labeling

What Commenters Said:

The Department of Defense commented that the national security exemption at 40 CFR 89.908, 94.908 and 40 CFR 1068.225 should be modified to include a labeling requirement for national security exempt engines. They stated that the national security exemptions for nonroad engines associated with military combat do not have labeling requirements, which may lead to confusion regarding the exempt status of engines in service, and therefore EPA should add a provision with an appropriate labeling requirement. DoD also recommended specific regulatory language that should be incorporated into the proposed rule to address this issue.

Letters:
Department of Defense, OAR-2003-0012-0617 p. 6-7

Our Response:

We agree with DoD that adding labels to these sections is appropriate, and have incorporated the suggested language.

10.3.2 Technological or Logistical Considerations

10.3.2.1Number of Fuel Grades and Contamination Issues

What Commenters Said:

AOPL commented that the proposed nonroad rule will increase the number of fuel grades that require separation in the distribution system, which will increase operational challenges for refiners and inefficiencies in the market. The proposed rule creates a new set of refined product qualities and necessitates new segregation and sequencing decisions for the refined petroleum distribution system. The new rule will create distinct categories of distillate fuels and diesel, reaching as many as five in the mid-2007 to mid-2010 time period. The effect is to require additional segregations in product shipping and distribution and the movement of smaller product batches. After the phase-in, the highway rule would have required two products, highway and nonroad diesel/distillate heating oil. However, the proposed rule now requires segregation for four products, which will introduce operational challenges and inefficiencies while providing no environmental benefit. EPA should add flexibility back into the rule by eliminating limitations on fungibility that do not provide any environmental benefit. For example, the need to separate dyed 500 ppm NRLM and the small refiner NRLM during the 2007 - 2010 time period is unclear. In addition, pre-2011 engines may use 500 ppm nonroad fuel from small refiners as well as early credit fungible NRLM 500 ppm fuel prior to mid-2010, but EPA's policy prevents the use of NRLM fuels for these unchanged engines.

Letters:
New York Public Hearing, A-2001-28, IV-D-05 [AOPL p. 177]

The Texas Commission on Environmental Quality and CHS commented that EPA should evaluate enforcement issues as it relates to fuel contamination. Delivery trucks that carry and discharge all of the 500 ppm diesel, then refill with 15ppm, are most likely to experience some contamination. Any requirement that truck tanks be "cleaned" is impractical, burdensome, and too costly. EPA should study this issue and establish acceptable contamination and adulteration standards. Further, the Texas Commission on Environmental Quality commented that EPA should clarify how it intends to ensure that pipeline fungibility will not adversely affect sulfur content in nonroad diesel given that pipelines are commonly shared with jet fuel or kerosene that have a maximum sulfur content of 3,000 ppm.

Letters:
CHS Inc., OAR-2003-0012-0785 p. 5
Texas Commission on Environmental Quality, OAR-2003-0012-0716, 0717 p. 1

The Associated General Contractors of America commented that EPA should allow off-spec highway diesel fuel to be co-mingled with 500 ppm nonroad diesel for sale to the nonroad segment. This approach would preserve efficiencies in the refined product transport and storage system, thereby helping to keep costs down, while providing a superior fuel to the off-highway market at a reasonable cost.

Letters:
Associated General Contractors of America, OAR-2003-0012-0791 p. 13-14

Our Response:

EPA has significantly revised the provisions on downstream distribution from the proposal. The designate-and-track provisions adopted in the final rule are designed to maximize the fungible distribution of diesel fuel and distillates while ensuring high confidence in the ability of the fuel program to provide fuel with the appropriate sulfur level. Under the designate and track provisions of the final rule, refiners/importers must identify whether their diesel fuel is highway, NR, or LM and the applicable sulfur level. The fuel marker will be added at the terminal instead of at the refinery gate as proposed. As a result, highway and NRLM diesel fuels meeting the same sulfur specification may then be mixed, as NRLM diesel fuel need not be dyed at the refinery gate. With these changes from the proposal, the fuel distribution system will be simplified, as there will not be a need to separate as many grades of fuel as under the proposal. A list of all possible product segregations is shown in Chapter 5.5.1.2 of the RIA. However, in most areas of the country, we anticipate that only a subset of these fuels will be carried separately.

In regards to the comments on fuel contamination, we note that we expect to enforce the liability scheme of the NRLM diesel sulfur rule in the same manner that we have enforced similar liability schemes in our prior fuels regulations. As in other fuels programs, we will attempt to identify the party most responsible for causing the violation, recognizing that that party should primarily be liable for penalties for the violation. Regulated parties are subject to prohibitions which are typical in EPA fuels regulations, such as prohibitions on selling or distributing fuel that does not comply with the applicable standard, and causing others to commit prohibited acts. Liability will also arise under the NRLM diesel rule for prohibited acts specific to the diesel sulfur control program, such as introducing nonroad diesel fuel not meeting the 15 ppm sulfur standard into model year 2011 or later nonroad equipment.

However, due to the need to prepare for compliance with the highway diesel program, we anticipate that issues related to limiting sulfur contamination during the distribution of 15 ppm NR and LM diesel fuel will be resolved well in advance of the 2010 implementation date for 15 ppm sulfur standard for NR fuel. We expect that the mitigation strategies implemented for all sulfur contamination issues associated with the highway diesel 15 ppm standard can be extended to sulfur contamination issues associated with the nonroad 15 ppm standard. This will be true for all points in the distribution system, including delivery trucks. We are not aware of any additional issues that might be raised unique to nonroad fuel. If anything we anticipate limiting contamination will become easier. We expect that 15 ppm nonroad diesel fuel will be distributed in fungible batches with 15 ppm highway diesel fuel up to the point when it leaves the terminal and nonroad diesel fuel must be dyed per IRS requirements. The resulting larger batch sizes as a percentage of the total 15 ppm diesel throughput may make it somewhat easier to limit sulfur contamination and could reduce losses to product downgrade during transportation by pipeline. We also expect that the projected absence of high-sulfur diesel fuel and heating oil in many pipeline systems will lessen the opportunity for sulfur contamination. As a result, if anything the opportunity for contamination should decline with the expansion of the 15 ppm pool to include NRLM in addition to highway diesel fuel.

Because of the extreme sulfur sensitivity of the expected engine emission control systems of Tier 4 compliant nonroad diesel engines, it is imperative that the distribution system segregate nonroad diesel fuel subject to the 15 ppm sulfur standard from higher sulfur distillate products, such as 500 ppm diesel fuel produced by small refiners or through the use of credits, heating oil, and jet fuel. If a fuel meeting the ultra-low sulfur standards is mixed or contaminated with a higher sulfur fuel, it must be downgraded to the higher sulfur product and new documentation (e.g., PTD, label) must be created to reflect the downgrade. We do not believe that tank truck compartments will need to be cleaned before being used to transport 15 ppm diesel fuel. We did project that existing procedures to ensure that a tank compartment in completely drained would need to be observed prior to its use to transport 15 ppm diesel fuel. See section 5.5. regarding limiting sulfur contamination during the distribution of diesel fuel subject to a 15 ppm sulfur standard.

Finally, regarding the comment from the Associated General Contractors of America, we do allow downgraded product to be commingled with 500 ppm fuel under the provisions of the final rule. See section IV of the preamble and Chapter 5.5 of the RIA for more information on downstream provisions.

10.3.2.2Anti-Downgrading Provisions

What Commenters Said:

A number of commenters stated that EPA should not implement the proposed downgrade limitation for nonroad diesel fuel. Section 80.527 of the proposed rule limits the volume of diesel fuel that can be reclassified from the 15 ppm on-highway pool to nonroad, locomotive and marine. The rule would force any 15 ppm downgrades greater than the 20 percent allowed under the highway diesel rule out of the nonroad market. The only option for downgraded fuel in excess of this amount is to sell it for stationary use such as heating oil. These downgrade limitations erode the flexibility of the logistical network at a time when additional flexibility is necessary. Since the stationary source market for downgraded fuel is small, EPA is effectively mandating the reprocessing of any low sulfur diesel downgrades greater than 20 percent.

AOPL noted that EPA should reconsider this provision since: 1) downgraded fuel in the off-road market will not affect demand for on-road low sulfur diesel, 2) there is no environmental benefit that would result from this restriction, and 3) the market impacts of this restriction may prevent the smooth transition to a lower sulfur content fuel. AOPL also described why heating oil is generally an unsuitable outlet for downgraded 15 ppm fuel and the various adverse effects that could occur to the distribution system as a whole as a result of this provision. Similarly, API objected to this provision on the basis that 1) it significantly changes the stringency of the highway diesel regulation, 2) has no impact on highway 15 ppm volumes, 3) overly limits the spillover of highway diesel into nonroad diesel markets, and 4) would force nonroad diesel terminal customers to pay highway diesel taxes. Exxon specifically recommended that EPA: 1) remove the downgrade limitation or retain only highway low sulfur diesel as the downgrade destination limitation, and 2) adopt the broadest possible interpretation of the "custody and title holder" language so that ultra-low sulfur diesel's unique low sulfur properties, even if slightly contaminated, can continue to meet a viable vehicle usage. The commenters provided additional discussion on this issue and recommended that EPA eliminate the provision.

Letters:

American Petroleum Institute, OAR-2003-0012-0804-0808 p. 12
Association of Oil Pipelines, OAR-2003-0012-0609 p. 12-17
Citgo Petroleum Corporation, OAR-2003-0012-0707 p. 8
Colonial Pipeline Company, OAR-2003-0012-0694 p. 3
ConocoPhillips, OAR-2003-0012-0777 p. 3
ExxonMobil, OAR-2003-0012-0616 p. 23
Flint Hills Resources, OAR-2003-0012-0667 p. 6
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 8
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 7, 15-17
Tesoro, OAR-2003-0012-0662 p. 7
Williams Energy Partners, OAR-2003-0012-0626 p. 1-2
Chicago Public Hearing, A-2001-28, IV-D-06 [AOPL p. 103-108]

Our Response:

The designate and track provisions being finalized today will allow 500 ppm highway and 500 ppm NRLM to be tracked separately. This will enable the anti-downgrading requirements to only apply to the downgrading of 15 ppm highway diesel fuel to 500 ppm highway fuel, as originally required in the 2007 highway final rule. The designate and track provisions also provide clarity on implementation of the anti-downgrading provisions, such as who the responsible parties are, and specifically how compliance can be calculated. See section IV.D of the preamble to today's rule for a complete discussion of the provisions of this program.

10.3.2.3Timing (for Enforcement)

What Commenters Said:

AOPL commented that EPA should reconsider the enforcement timing under the proposed rule. Section 80.610 of the proposed rule lists acts that are prohibited as of June 1, 2007 and June 1, 2010, depending on the provision. However, under the provisions of Section 80.511, the per gallon standards of section 80.510 apply on August 15, 2007 and September 1, 2010, respectively, at downstream locations other than retail outlets or wholesale producer-consumer facilities. This mismatch could create the possibility for a violation before a downstream party is subject to the rule.

Letters:
Association of Oil Pipelines, OAR-2003-0012-0609 p. 24
New York Public Hearing, A-2001-28, IV-D-05 [AOPL p. 180]

AOPL also commented that under section 80.527, the measurement of downgrade volumes begins on June 1, 2007 under the proposed rule, while a downstream party such as a pipeline is not subject to the requirements to segregate the different products until August 15, 2007. This would appear to be an error in the drafting of the proposed rule. EPA has recognized the necessity to saturate the transportation and distribution system with the new product before imposing the rule downstream by codifying the latter downstream date, which the compliance section of the rule appears to undercut. Imposing the downgrade limitation during the critical transition period would be burdensome and has no environmental benefit.

Letters:
Association of Oil Pipelines, OAR-2003-0012-0609 p. 24
New York Public Hearing, A-2001-28, IV-D-05 [AOPL p. 181]

Williams Energy Partners and AOPL commented that there is a compliance and enforcement issue associated with the calculation of the 20 percent annual limitation. This calculation begins on June 1, 2006 and June 1, 2007, before the per gallon sulfur limitations apply to downstream parties. Enforcement provisions under the rules should not apply to downstream parties until the date the rules become applicable to them.

Letters:
Williams Energy Partners, OAR-2003-0012-0626 p. 3
Chicago Public Hearing, A-2001-28, IV-D-06 [AOPL p. 107]

Our Response:

Commenters have correctly identified an error in the proposal. For the final rule, we have shifted the start date for compliance with the anti-downgrading provisions to October 1, 2006. This allows for the blending-down of storage tanks in the distribution system at the start of the highway program as we had originally intended. In addition, the prohibited acts in §80.610 generally refer back to the provisions that establish a standard or other requirement. It is not a violation of a prohibited act under §80.610 with respect to such standards or requirements unless the person has not met the applicable standards or requirements, and this cannot occur until after the implementation of the standard or requirement. For example, downstream parties are not in violation of the standards in §80.511 until after the applicable dates in §80.511, therefore there is no violation of a prohibited act in §80.610 based on these standards until after the applicable date in §80.511.

10.3.2.4Diesel Fuel Treated as Blendstock (DTAB)

What Commenters Said:

IFTOA commented that it supports EPA's proposal to allow off-spec 15 ppm diesel fuel to be considered "diesel treated as blendstock". Allowing for DTAB fuel to be blended with lower sulfur diesel fuel to meet the nonroad or highway standard would provide essential flexibility for refiners and would promote the availability of low-sulfur diesel fuel. This approach has worked very well as part of EPA's reformulated gasoline program.

Letters:
Independent Fuel Terminal Operators Association, OAR-2003-0012-0671, 0672 p. 4-5

Our Response:

We are finalizing provisions that allow for the suggested use of DTAB. Under today's program, a situation could arise for importers where fuel that was expected to comply with the 15 ppm NRLM standard is found to be slightly higher in sulfur than the standard. Rather than require the importer to account for and report such fuel as 500 ppm fuel, we are allowing that the importer to designate the noncomplying fuel as blendstock – "diesel fuel treated as blendstock" or DTAB – rather than as NRLM diesel fuel. In its capacity as a refiner, the party can then blend this DTAB fuel with lower sulfur diesel fuel, or other blendstocks, to cause the sulfur level of the combined product to meet the 15 ppm NRLM sulfur standard prior to delivery to another entity. The same situation exists with respect to compliance with the 15 ppm highway standard, however no provision was made in the 2007 highway final rule for this. Thus, we are also finalizing the DTAB provisions in this final rule for application to 15 ppm highway diesel fuel. More discussion on the DTAB provisions is located in section V.B.3 of the preamble.

10.3.3 Recordkeeping and Reporting Requirements

10.3.3.1General Comments

What Commenters Said:

API commented that it supports our proposed recordkeeping and reporting requirements. API also commented that it applauds EPA's effort to define a compliance monitoring and reporting mechanism that will allow for the fungible shipment and storage of undyed 500 ppm sulfur highway and nonroad diesel fuel. Such a mechanism would reduce the impacts of this rule on the distribution system, and consequently help address concerns about adequate deliverability of diesel fuel to local areas. EPA should maintain the strong product transfer documentation and labeling requirements for different diesel fuels that will be in the market from 2006 through 2014.

ExxonMobil commented that the annual reporting requirements for highway and nonroad diesel are inconsistent. The highway rule requires annual compliance reports by the end of February for the preceding calendar year. The nonroad rule requires annual compliance reporting by the end of August for the preceding June 1 through May 31 period. This inconsistency will unduly complicate reporting and determination. Compliance reports would be more valuable if both the highway and nonroad reports were consolidated and reported on a common time frame, particularly if highway and non-highway baselines are going to be involved in the compliance scheme.

Letters:
ExxonMobil, OAR-2003-0012-0616 p. 24
New York Public Hearing, A-2001-28, IV-D-05 [API p. 19]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [API p. 42]
Chicago Public Hearing, A-2001-28, IV-D-06 [API p. 90]

Our Response:

Today's program includes requirements similar to those that were in the NPRM. However we are requiring that each custodian in the distribution chain must keep track of the fuels they receive and the fuels they deliver, as part of the designate-and-track program discussed in the preamble. Records and reports are required that permit the tracking of fuel, and allow ready enforcement of the various restrictions under which fuel can be redesignated. While the designate and track requirements are slightly more stringent than requirements that are currently in place, feedback from parties in all segments of the fuel distribution system has shown that these requirements are in line with information that is already kept as part of normal business practice. Therefore, only modest upgrades would be needed for most recordkeeping procedures.

We also concur that both highway and nonroad fuel compliance reports should be consolidated and reported on a common time frame. We have taken steps in this final rule to harmonize compliance periods and reporting timing for the two programs.

10.3.3.2Product Transfer Documents (PTDs)

What Commenters Said:

The Alaska Department of Environmental Conservation commented that EPA should simplify the language of product transfer documents for Alaska-bound fuel. As with pump labels, product transfer documents should reflect appropriate source use of fuel with different sulfur levels depending on the date.

Letters:
Alaska Department of Environmental Conservation, OAR-2003-0012-0607 p. 3

FHR commented that the PTD statements specified in Section 80.590 should be revised for use on Bills of Lading (BOLs). The required text should be simplified and shortened. Most BOLs have limited capability for printing notes and other text. The length of the notes specified in this section could require the printing of a second sheet to the BOL. The notes should be shortened so that drivers and others in the distribution chain are more apt to read and understand them. The commenter also provided additional discussion on this issue and recommended specific revisions to this section.

Letters:
Flint Hills Resources, OAR-2003-0012-0667 p. 7

FHR commented that the PTD text for title transfer is unnecessary. The proposed rule requires specific verbiage and information on a PTD whenever there is a change of custody or title, which is beyond normal business needs. Such information on a PTD at change of custody may be necessary to ensure that only complying product is delivered. However, this information is not needed for the change of title PTD. When the change of title information is conveyed via EDI, the data is handled electronically and even if a person views the data and recognizes noncomplying material, they are generally not in a position to remove the product from commerce. EPA should remove the PTD requirements for "Change of Title" since they serve no purpose and are burdensome.

Letters:
Flint Hills Resources, OAR-2003-0012-0667 p. 7-8

Our Response:

The language required for the product transfer documents has been chosen on the basis of the need to ensure full compliance with the standards. We believe it would unduly complicate the recordkeeping and reporting process to have multiple versions of product transfer documents such as the Alaska DEC suggested, and that a simpler version of PTDs intended to keep Bills of Lading to a single page would necessarily leave out information that we deem critical to the successful tracking of fuel batches. In addition, while we recognize that the requirements may add an additional burden for some parties in the fuel distribution system, PTD requirements for “changes of title” are necessary in the event of a change of custody or title, in which the receiver of the fuel would like to redesignate the fuel, and are also needed for EPA to track potential liability for standards violations. Under our fuels regs, distributors who don't have custody but do take title are potentially liable. Therefore, the product transfer document language and requirements for "change of title" will be finalized as proposed.

10.3.3.3Aromatics Reporting Requirements

What Commenters Said:

Some commenters commented that the reporting of aromatics should not be required if the refiner is complying with the cetane index requirement (or vice versa). Under Section 80.510(a) and (b), EPA requires compliance with a minimum cetane index of 40 or a maximum aromatic content of 35 volume percent. However, Section 80.599 in the proposed rule would require batch reporting for those using the baseline approach and (e)(5) would require reporting of the cetane and aromatics content of the fuel. The reporting requirement should be cetane or aromatics, not both.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 13
ConocoPhillips, OAR-2003-0012-0777 p. 5
ExxonMobil, OAR-2003-0012-0616 p. 15
Flint Hills Resources, OAR-2003-0012-0667 p. 9
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 9
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 23

Our Response:

We agree that the batch reporting of cetane index or aromatics levels for off-highway diesel fuel is not necessary. The regulations regarding a minimum cetane index of 40 or a maximum aromatics content of 35 volume percent for highway diesel fuel do not include any batch reporting requirements. We see no need to impose such batch reporting requirements on off-highway fuel at this time. However, we will continue to require that producers of off-highway diesel fuel keep records of the cetane index and/or aromatics levels of each batch.

10.3.4 Downstream Compliance Issues

10.3.4.1Downstream Marker Usage

What Commenters Said:

We received comments from several stakeholders that we should allow for the downstream use of a marker. These commenters believed that we should revise the requirement for markers that would distinguish heating oil and locomotive/marine diesel from other distillates, to allow for the marker to be added downstream of the truck rack, which would be similar to the current nonroad IRS dye requirements. This would allow the introduction of the marker anywhere upstream of that point. Even though downstream injection may result in a greater capital investment by the industry, marker injection at the end of the distribution system would reduce the impact on the system as well as concerns related to aviation kerosene. This approach would allow industry to determine the best solution for marker injection and would minimize downstream issues. In addition, API added that using dye in nonroad diesel at the refinery would limit refiners' flexibility with respect to the distribution of fuel batches.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 14-15
Colonial Pipeline Company, OAR-2003-0012-0694 p. 5
ExxonMobil, OAR-2003-0012-0616 p. 16
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 9-10
New York Public Hearing, A-2001-28, IV-D-05 [API p. 23]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [API p. 42]
Chicago Public Hearing, A-2001-28, IV-D-06 [API p. 90]

FHR and NPRA commented that lacking visual evidence, the distribution system will be required to perform frequent testing, especially on aviation fuel which has strict standards prohibiting most any additive in the fuel. Addition of the marker downstream of the terminal will minimize, if not eliminate, potential contamination of aviation kerosene.

Letters:
Flint Hills Resources, OAR-2003-0012-0667 p. 6-7
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 23

Our Response:

As part of the designate-and-track provisions adopted in the final rule, today's program will not require that the marker be added until the fuel reaches the terminal, rather than at the refinery gate as we proposed in the NPRM. Further, the marker will now only be present when red dye is also present, thereby mitigating the jet fuel contamination concern. The cost of shifting the location of marker addition to the terminal has been significantly minimized by structuring the final rule such that marker is no longer required in much of the Northeast and mid-Atlantic (i.e. the Northeast/Mid-Atlantic Area) as discussed in section IV.D. of the preamble.

10.3.4.2Use of Static Dissipator Additives (SDAs)

What Commenters Said:

A few commenters stated that EPA should allow for the downstream use of static dissipator additives (SDAs), in a manner that minimizes the contribution to fuel sulfur content and the possibility of electrostatic hazards. SDAs prevent the possibility of electrostatic ignition during tank truck loading. An electrostatic charge accumulates in the fuel through the process of pumping, filtration, and movement through the piping and this phenomenon cannot be completely eliminated through proper grounding and bonding. Since electrostatic charging cannot be reasonably controlled and since the elimination of flammable vapors is impractical, SDAs are necessary to prevent charge accumulation by increasing the conductivity of fuel to greater than or equal to 50 pS/m. These additives are particularly important in low sulfur fuels since the base fuel conductivity is generally lower leading to electrostatic hazards that are 30 times higher as compared to standard higher sulfur fuels. EPA should allow for the downstream addition of SDAs for several reasons. First, addition at the refinery is impractical because pipelines do not permit SDA in fuels, and because pipeline adsorption, the loss in conductivity during transport, and temperature extremes contribute to a higher level of uncertainty regarding the amount of SDA required. Second, equipment is available to control the SDA addition rate more precisely downstream. Third, it is relatively easy for terminal operators to measure SDA usage versus fuel volume to assure excessive quantities are not used. The controlled downstream use of SDA is possible without a re-measurement of sulfur since the most likely sulfur contribution attributable to the terminal addition of SDA would be small, ranging between 0.02 and 0.05 ppm.

Letters:
Sunoco, OAR-2003-0012-0509 p. 1-14
Williams Energy Partners, OAR-2003-0012-0626 p. 3-4
New York Public Hearing
A-2001-28, IV-D-05 [1 public citizen (CP Henry) p. 216-220; Octel-Starreon p. 199]

API and Marathon commented that EPA should not require test results to confirm compliance with the sulfur standard following the addition of SDAs. Since lowering the sulfur in diesel fuel reduces its conductivity, the use of static dissipator additives (SDA), which have sulfur contents exceeding 15 ppm, is necessary. Section 80.613(a)(1)(vi) of the proposed regulations provides that in order to establish a defense to a presumptive violation, test results must be obtained subsequent to the blending of the additive into the fuel. However, Section 80.521(b) provides that a diesel fuel additive may have a sulfur content exceeding 15 ppm provided that, among other things, the additive is used in a quantity less than 1 percent by volume. The requirement under Section 80.613(a)(1)(vi) is overly burdensome and unnecessary. Adequate enforcement of diesel sulfur content can be achieved through records that show SDA use against fuel volume through the terminal. EPA has taken this approach in other circumstances and it should be allowed under the proposed rule.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 21-22
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 17

AOPL and Williams Energy Partners commented that the dosage rate of SDAs is typically very low and the overall impact on the final sulfur level of the diesel fuel is insignificant. Given the minimal impact, EPA should simplify the requirements for establishing a defense under Section 80.613(a)(1)(iv) for the addition of SDA. Williams specifically added that the proposed rule is contradictory with regards to the need to test for sulfur as a result of blending additives that contain sulfur in excess of 15 ppm and that EPA should reconcile the language in Section VIII(C)(5) as compared to Section VIII(G)(c). This commenter recommended that EPA: 1) establish the operating philosophy provided in Section VIII(C)(5) as the method by which compliance diesel fuel is maintained in the distribution system; 2) eliminate the provisions for testing as an element of an affirmative defense; and 3) allow for documentation that the additive was not blended at a concentration greater than the manufacturer's maximum treat rate as well as a statement of the sulfur concentration on the PTD as sufficient documentation for compliance. Williams also added that the act of blending additives should not compromise refiners' entitlement to the 2 ppm adjustment factor.

Letters:
Association of Oil Pipelines, OAR-2003-0012-0609 p. 21
Williams Energy Partners, OAR-2003-0012-0626 p. 4

Environmental Defense commented that the use of any additives should not cause fuel to exceed the 15 ppm standard. Environmental Defense also stated that it supports the liability provisions for additive manufacturers and distributors, and parties that blend additives in diesel fuel.

Letters:
Environmental Defense, OAR-2003-0012-0821 p. 17

Our Response:

Static dissipater (S-D) additives are necessary in certain batches of fuel that do not have adequate static dissipating qualities to prevent a static discharge from occurring during the transfer of fuel into a storage tank (which might cause an explosion). Therefore, it is essential that today's rule is structured in such a way so as to not impede the use of S-D additives. The need for S-D additives in some fuel batches meeting a 15 ppm sulfur specification was confirmed by a fleet operator that is currently using ultra low sulfur diesel (ULSD) fuel.[53] This party related that they had received batches of ULSD with a conductivity ranging from 0.002 - 0.005 pS/m, whereas authoritative sources recommend a minimum conductivity of >50 pS/m.[54]

Feedback from registered S-D additives manufacturers has shown that there are no fully-effective S-D additives available that have a sulfur content below 15 ppm. We were further informed that sulfur is an essential component in S-D additives, and that it is currently unclear how to formulate a S-D additive that would have a sulfur content below 15 ppm (and their reformulation to meet a 15 ppm sulfur cap will likely be a lengthy undertaking). Finally, we were informed that these additives cannot be added at the refinery due to issues associated with its transport by pipeline. Because of this input, we now recognize that S-D additives are in a unique category with respect to the ability to comply with a 15 ppm sulfur cap.

Today's rule includes special affirmative defense provisions to reduce the sulfur testing burden associated with the use of S-D additives that have a sulfur content greater than 15 ppm due to the lack of S-D additives meeting a 15 ppm sulfur specification, the unique difficulty in reformulating them to meet a 15 ppm standard, and the fact that they are essential to the safety of the fuel distribution system. We are finalizing provisions for blenders of S-D additives similar to the approach suggested by commenters. The provisions do not require testing of MVNRLM at the terminal after additization. More detail about this approach and the modifications that we are finalizing can be found in section V.C.5 of the preamble.

[53] Phone conversation between Curtis Cummings, Fed-Ex Freight, and Jeff Herzog, EPA, April 13, 2004.

[54] This party added S-D additive to remedy the low conductivity of the fuel.

These provisions may only be used for S-D additives which have the potential to raise the sulfur content of the finished fuel by no more than 0.050 ppm when used at their maximum recommended treatment level. Based on the input from additive manufacturers noted above, this will allow the use of S-D additives that are fully effective for this purpose. The use of S-D additives that might have a higher contribution to the sulfur content of the finished fuel, therefore, is unnecessary. Under no circumstances may an additive blender cause the sulfur level of any batch of finished fuel to exceed the 15 ppm sulfur cap. Blenders of S-D additives must meet all other requirements for distributors of 15 ppm diesel fuel. Regardless of the cause of a violation of the 15 ppm sulfur standard, any party that had custody of off-specification fuel is potentially liable and responsible for their affirmative defense elements.

We are also amending the highway diesel regulation so that the provisions finalized today regarding the use of S-D additives with a sulfur content above 15 ppm in NRLM diesel fuel also apply to the use of such additives in highway diesel fuel subject to a 15 ppm sulfur standard. The special provisions for S-D additives finalized in today's rule will ensure that the unique challenges regarding the manufacture and use of such additives do not present a barrier to their continued use.

Finally, in response to the comment that additives should not cause any fuel to exceed the standard, we note that the additive provisions are designed to implement the requirement that any given batch of additized fuel must still meet its applicable standard. No parties in the fuel distribution system will be allowed to introduce an additive into a fuel that would cause the fuel to exceed its applicable sulfur standard. The S-D provisions don't allow the additized product to have a sulfur content greater than 15 ppm.

10.3.4.3Testing and Sampling Methods

What Commenters Said:

ConocoPhillips commented that EPA should recognize that testing and sampling methods have inherent variability that must be recognized in downstream enforcement actions. The adjustment for downstream standards proposed by the agency for 15 ppm product, i.e. 2 ppm, does not fully recognize the limitations of current or future sampling and testing systems under the context of liability provisions set forth in the Agency's rules. A testing tolerance or adjusted downstream standard of 5 to 7 ppm more appropriately represents the degree of accuracy that can be expected in this area. Absent this adjustment, the refining industry will need to produce ultra-low sulfur diesel at sulfur levels one-third to one-half of the standard to ensure compliance. Designing and operating to these stringent levels would be costly and difficult and could increase the risk of non-compliance, thus having an adverse impact on the distribution system.

Letters:
ConocoPhillips, OAR-2003-0012-0777 p. 5

Our Response:

We are finalizing the two ppm adjustment in today's rule. We believe that the reproducibility of sulfur test methods will improve to two ppm (or even less) by the time the 15 ppm sulfur standard for highway diesel fuel is implemented – which is four years before implementation date of the 15 ppm standard for NR diesel fuel. However, we do plan to reevaluate whether two ppm is the appropriate allowance as test methods improve in the future. Further discussion can be found in section V.D.2 of the preamble.

10.3.4.4 Downstream Transition Schedule

What Commenters Said:

ConocoPhillips commented that EPA should propose the same downstream transition schedule for the step down to 500 ppm fuel as is used for the step down to 15 ppm fuel. The downstream transition schedule should remain the same for both steps since the actual transition at terminals and retail facilities to achieve the 15 ppm level will be as difficult as the first transition step to 500 ppm. Allowing a slightly longer timeline will be beneficial to the terminals and retail outlets.

Letters:
ConocoPhillips, OAR-2003-0012-0777 p. 2

Our Response:

To allow adequate time for tank turnover for downstream parties, we are finalizing that terminal operators will be allowed until August 1, 2010, wholesale purchaser-consumer facilities (including bulk plants) and retail outlets will be allowed until October 1, 2010, and all other downstream parties will be allowed until December 1, 2012 for final compliance with the 500 ppm NRLM standards. Similarly, we are finalizing a provision allowing all distributors up to and including terminal operators until August 1, 2014, wholesale purchaser-consumer facilities (including bulk plants) and retail outlets until October 1, 2014, and all other downstream parties until December 1, 2014 for final compliance with the 15ppm NR sulfur standard. Given the long transition time from 2007 to 2010 for 500ppm fuel, and from 2010 to 2014 for 15ppm fuel, there should be ample opportunity for fuel distributors to transition their systems.

10.3.5 Transmix Operator Compliance Issues

10.3.5.1 Treatment of Transmix Processors

What Commenters Said:

ExxonMobil, Kinder Morgan, API, and AOPL commented that transmix processors should be treated differently from refiners. The volume of transmix is likely to increase as low sulfur diesel is introduced. Transmix processors must be free to process transmix or nonblendable interface volumes into a marketable product without incurring the increased cost and lost production capability that would result from having to return incremental transmix and interface volumes to refineries for processing. These processors will be performing an important and growing service and their potential throughput should not be limited.

Letters:
ExxonMobil, OAR-2003-0012-0616 p. 22

Kinder Morgan, OAR-2003-0012-0603 p. 1-2
New York Public Hearing, A-2001-28, IV-D-05 [API p. 22]
Los Angeles Public Hearing, A-2001-28, IV-D-07 [API p. 45]
Chicago Public Hearing, A-2001-28, IV-D-06 [API p. 89; AOPL p. 99]

API and Marathon commented that if a transmix processor wants to bring in "blendstocks" to blend in with the diesel produced from processing the transmix, they would be classified as a refiner and subject to the associated restrictions. There should be some provision to allow this on a limited basis, perhaps by applying a percentage limitation on production including blendstocks.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 20
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 12

AOPL, ExxonMobil, Williams, and NPRA commented that the transmix processor is part of the downstream distribution process and therefore, should not be treated as small refiners or subject to any baseline volume limitations. Pipelines do not have the ability to hold large amounts of transmix in existing tankage and will need fully functional transmix processors to properly handle and dispose of transmix in order to avoid tank lock-outs and other distribution problems. EPA should revise its proposal to allow transmix processors to sell its separated distillate into any market, provided the applicable product specifications are met. In this context, one commenter (NPRA) cites specifically to the volume restrictions under Sections 80.522(a), 80.554(a), and 80.554(b). *[See related discussion under Issue 4.4.]*

Letters:
Association of Oil Pipelines, OAR-2003-0012-0609 p. 21-22
ExxonMobil, OAR-2003-0012-0616 p. 22
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 17-18
Williams Energy Partners, OAR-2003-0012-0626 p. 2-3

Flint Hills Resources commented that EPA should clarify that Section 80.513 only applies to the transmix processing facility and not to all facilities of that refiner.

Letters:
Flint Hills Resources, OAR-2003-0012-0667 p. 8

ConocoPhillips commented that EPA should modify the proposed provisions that apply to transmix processors. In the proposed rule, Section 80.513 outlines some flexibility provisions for transmix processors. Part (d) of this section creates some confusion since it appears to limit the flexibility options only to volumes produced from previously certified diesel (PCD) and does not mention transmix volumes (gasoline/diesel mixtures), which may be a mixture of gasoline and other non-PCD distillate such as jet or kerosene. This differentiation should be removed or clarified to allow maximum flexibility and continued handling of common gasoline distillate mixtures resulting from transport needs.

Letters:
ConocoPhillips, OAR-2003-0012-0777 p. 5

ConocoPhillips further commented that the current transmix blending guidance, contained in the question and answer document for the reformulated and conventional gasoline regulation, is old, needs to be updated and is more restrictive than necessary. For example, the current guidance limits transmix blending to terminals that historically blended transmix prior to 1994. Many terminals have seen significant technology upgrades over the past 10 years and would be capable of blending transmix in a way that was protective of product quality. There have also been changes in pipeline capacities, logistics, etc. that may have impacted the logistics at a particular terminal. EPA should review and update guidance for transmix blenders and should not limit the increased flexibility just to transmix processors. The commenter noted that it would like to discuss a QA approach for transmix blending at terminal locations.

Letters:
ConocoPhillips, OAR-2003-0012-0777 p. 6

Some commenters stated that the small refiner baseline process and the 105 percent limitation should not apply to facilities that process only transmix. Under the proposed rule, transmix processors can elect to be treated as small refiners and will be allowed to produce the same diesel fuels as small refiners and it appears that the small refiner baseline process and the 105 percent limitation on baseline volumes would also apply to transmix processors. The proposed requirement for transmix processors to meet the 80/20 requirements for volumes that exceed 105 percent of a baseline volume should be eliminated. Several studies have suggested that there will be increased volumes of transmix and interfacial mix generated through the transportation systems to ensure the integrity of the low sulfur product is protected. Since transmix volumes have the potential to increase significantly under both the highway and nonroad diesel rules, the 105 percent limitation is unreasonable and would significantly impact the ability of the distribution system to properly handle and dispose of transmix.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 20
ConocoPhillips, OAR-2003-0012-0777 p. 5
ExxonMobil, OAR-2003-0012-0616 p. 22
Kinder Morgan, OAR-2003-0012-0603 p. 2
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 12
Williams Energy Partners, OAR-2003-0012-0626 p. 2-3

Our Response:

As discussed in section IV.B.3 of the preamble, we recognize the potential disproportionate burden on transmix processors. Today's final rule removes the restriction on the volume of highway or NRLM diesel fuel they produce from transmix, by typical operational practices involving separation of transmix. However, we are limiting the flexibility to volumes that are reprocessed. Transmix processors cannot produce diesel fuel by combining blendstocks and avoid compliance. The special provisions for transmix processors only apply to the diesel fuel they produce by distillation or other refinery processes. These provisions do not apply to diesel fuel produced by blending or to diesel fuel produced by facilities other than the transmix processing facility. In addition, we are extending this flexibility to compliance with the highway diesel sulfur program for the same reasons. Thus transmix processors may choose to continue to produce all of their highway diesel fuel to the 500 ppm sulfur standard until 2010. They may further choose to continue to produce all of their NRLM as high sulfur fuel until June 1, 2010, all of their NRLM to the 500 ppm standard until June 1, 2014, and all of their locomotive and marine diesel fuel to a

500 ppm limit indefinitely.

In regards to the comments about the 105% volume limitation, we have determined that this proposed provision would have unduly impacted the ability of transmix processors to produce complying fuel. We have therefore eliminated this limitation in the final rule.

This rulemaking does not deal with the issue of blending transmix into gasoline. We will take the comments on blending transmix into gasoline under advisement in our other actions.

10.3.6 Other Compliance Issues

10.3.6.1Credits

10.3.6.1.1 Credit Generation

What Commenters Said:

API, ExxonMobil, and Marathon commented that they generally support the proposed credit generation and use provisions, but provide suggestions for improvement. The proposed start date for generating early nonroad diesel credits is unnecessary. By limiting refiners' ability to generate credits to the period from June 1, 2009 to May 31, 2010, EPA would discourage the early introduction of 15 ppm nonroad diesel. Each refinery should have the option of deciding if ultra-low sulfur diesel production above the mandated 80 percent for highway ultra-low sulfur diesel is credited toward the highway credit program or the nonroad credits program, after June 1, 2009. API agreed that production that exceeds the requirements of the highway program TCO should not be allowed to generate credits for both the highway and the nonroad programs and so a refiner or importer would need to specify such credits as either highway or nonroad credits.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 17
ExxonMobil, OAR-2003-0012-0616 p. 17
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 11

Clean Air Task Force commented that EPA should not allow for additional refiner compliance flexibility. Any alternative program that would give additional flexibility to refiners should not be considered since it would compromise the integrity and benefits of the nonroad rule. Providing additional flexibility could also lead to shortages in the supply of 15 ppm nonroad diesel fuel.

Letters:
Chicago Public Hearing, A-2001-28, IV-D-06 [Clean Air Task Force p. 260]

API and Marathon commented that we should maintain the provision that allows for the generation of credits for the early production of 500 ppm or 15 ppm fuel prior to the compliance deadlines.

Letters:

American Petroleum Institute, OAR-2003-0012-0804-0808 p. 16
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 11
Los Angeles Public Hearing, A-2001-28, IV-D-07 [API p. 43]

Our Response:

The credit provisions are designed to preserve the integrity and the air quality benefits of the program. These provisions will provide implementation flexibility by facilitating a somewhat smoother transition at the start of the program in 2007 and again in 2010 with the second step to 15 ppm sulfur. Some refineries/import facilities may use the provision to comply early, others on time, and others a little later. Facilitating a smooth transition helps to ensure the environmental benefits of the program. In addition, we believe that the credit provisions are incentives that will help to encourage early compliance and they may also facilitate some of the environmental benefits of the program being achieved earlier than otherwise required. The requirements concerning sampling and testing, and the enforcement provisions, ensure the integrity of the credit program.

At the same time, in order to preserve the environmental benefits and integrity of the NRLM program, any early credits must result from new actions taken in response to compliance with the NRLM standards. Merely shifting designations from the 15 ppm highway fuel that refiners are producing in the 2007-2008 timeframe to a 15 ppm NR designation in 2009 would not provide any additional environmental benefits. These "windfall" credits would undermine the intended environmental benefits of the program, and if sufficient in number could interfere with the intended production of 15 ppm NR fuel in 2010 for the 2011 model year nonroad engines. Hence we are limiting the generation of 500 ppm credits to diesel fuel produced after June 1, 2006, and for 15 ppm credits to diesel fuel credits produced after June 1, 2009.

10.3.6.1.2 Credit for Biodiesel

What Commenters Said:

The National Biodiesel Board commented that the use of biodiesel should be incorporated into the credit program as another way to generate credits. Biodiesel's emissions benefits, lubricity characteristics and positive health effects uniquely position it to help refiners comply with the proposed rule. Use of biodiesel to generate credits would offer immediate benefits to air quality and would help meet the stated goals of the proposed rule by increasing air quality, reducing sulfur content and substantially benefit public health and welfare and the environment. EPA should define eligible entities broadly enough so as to allow the manufacture of biodiesel as an eligible generator of credits that could be banked or traded under the program. The commenter also noted that they are willing to work with EPA to further define equitable credit or reward opportunities for eligible low-sulfur diesel fuels including biodiesel.

Letters:
National Biodiesel Board, OAR-2003-0012-0776 p. 2-3

Our Response:

The process of removing sulfur from diesel fuel typically has the undesirable side effect of also reducing the fuel's inherent ability to lubricate fuel system components in diesel engines. This lubricity is easily restored through the use of additives, and we anticipate a widespread need for such additives under the proposed program. Biodiesel fuel is known to have excellent lubricity characteristics, and so will benefit from this new additive market. Whether biodiesel would be preferable to other available lubricity additives in terms of cost, impacts on sulfur concentration, storage, and other issues, is a matter best left to the market. Biodiesel might also be one strategy refiners might use to meet the 15 ppm sulfur standards early, due to biodiesel's inherently low sulfur levels. In such cases it would simply be the overall sulfur level of the blend, regardless of the concentration of biodiesel, which determined the eligibility for and amount of sulfur credits.

10.3.6.1.3 Credit Trading by PADD

What Commenters Said:

Sinclair Oil Corporation commented that EPA should limit NRLM credit trading to the region or PADD where the refinery is located. A company owning a small refinery in PADD IV as well as large refineries in other PADDs would, in many cases, find it most economical to generate NRLM diesel fuel sulfur credits at their large facilities and use them to delay investment at their small PADD IV refinery. In other words, the high cost of regulatory compliance with PADD IV refineries could lead to a disproportionate use (or dumping) of sulfur credits in the Rocky Mountain region relative to other regions of the country. If this occurred, it would delay environmental and visibility benefits of low sulfur NRLM diesel fuel in PADD IV and refiners (such as Sinclair) with most or all of their refining assets located in PADD IV will be competitively disadvantaged relative to large refiners owning a refinery in PADD IV. Therefore, EPA should limit credit generation and use to the PADD where the product is manufactured.

Letters:
Sinclair Oil Corporation, OAR-2003-0012-0704, 0829 p. 3-4

API, BP, ExxonMobil, and Marathon commented that credit trading should not be limited to the region or PADD where the refinery is located. Credit trading should be national in scope. In order for a credit trading program to provide real world flexibility to refiners, there must be a sufficient volume of credits traded on an annual basis to ensure that market equilibrium between supply and demand is achieved. The Highway Diesel rule's PADD restricted credit trading program fails to meet this objective and is unlikely to be effective in encouraging the creation and use of highway diesel credits for 500 ppm sulfur diesel fuel. Placing PADD restrictions on nonroad diesel credits would make this program even more inflexible than the highway program, given the expected smaller volume of credits and the single year timeframe for credit generation for high sulfur and 500 ppm NRLM credits. In addition, since there will be a smaller volume of nonroad diesel credits, having a national scope to this program is unlikely to adversely affect the supply of 15 ppm diesel.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 16-17
BP, OAR-2003-0012-0649 p. 4-5
ExxonMobil, OAR-2003-0012-0616 p. 18
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 11

Sunoco and Valero commented that EPA should consider allowing for a broader trading program since much of the national diesel market is based on fungible supply distribution between the PADD regions. Trading should be allowed between PADDs. Valero specifically noted that significant volumes of highway diesel (over 50 percent in 2002), are produced and exported from PADD III into other regions and that substantial flexibility in the diesel supply system will be lost if the excess credits generated in PADD III are not available to other PADD regions, especially PADD I. Valero further recommended that at a minimum, the transfer of credits between PADD I and PADD III should be allowed.

Letters:
Sunoco, OAR-2003-0012-0509 p. 2
Valero Energy Corporation, OAR-2003-0012-0628 p. 2

CHS commented that EPA should establish a procedure to allow refiners, especially small refiners, to petition EPA for permission to sell credits outside their PADDs or CTAs. The limitation of refiners from selling credits outside credit trading areas (CTA) may be detrimental to many small and single refinery refiners. EPA should provide additional flexibility to encourage the national desulfurization effort while protecting fuel supplies. Providing for additional flexibility in this context would help small refiners manage their costs of compliance and remain economically viable.

Letters:
CHS Inc., OAR-2003-0012-0785 p. 3

The National Oilheat Research Alliance (NORA) commented that EPA should limit the credit trading program to PADDs II through V. The cost of imposing a credit trading program and marking system in PADD I is disproportionately high. EIA data indicate that the ratio of heating fuels to off-road fuels in this PADD is 3.57 to 1.0. Thus, the number of gallons paying for the credit program is much higher than the potential gallons using the program. EPA should not implement a marking program or ABT program in any PADD where the ratio of heating fuels to off-road fuels exceeds 1.0. In addition to the cost savings, many small refiners are in PADD I and serve limited local markets, thus the elimination of PADD I from the ABT program would not have an adverse effect on the distribution system. NORA provided additional discussion on the cost-related benefits to refiners and consumers of eliminating PADD I from the trading program and cites additional benefits to the environment since the elimination of the marker would encourage the use of lower sulfur heating oil. NORA also noted that marking the credit gallons could be a reasonable alternative and that they could support an alternative approach that imposes the cost of the flexibility on those who actually benefit from it. *(See related discussion on cost under Issue 6.4.4 and related discussion on encouraging the use of lower sulfur heating oil under Issue 4.3.2).*

Letters:
National Oilheat Research Alliance, OAR-2003-0012-0840 p. 3-5

Our Response:

With any ABT program, there are always entities better positioned to take advantage of the flexibility than others. However, the advantages of these programs in enabling early environmental benefits at a lower cost typically offset any competitive disadvantages. In the highway rule we were compelled to limit credit trading to certain regions of the country (CTAs) to ensure nationwide availability of 15 ppm fuel for the vehicles that would need it. This is not an issue for this final rule. Therefore, we are finalizing the provisions to allow for nationwide credit trading in this rule.

However, as discussed in the preamble, we are precluding the use of credits in the Northeast/Mid-Atlantic Area and Alaska, along with restrictions on other program flexibilities as a reasonable restriction to facilitate removing the large burden that heating oil marker provisions would impose on those areas. Consequently, while credits can be generated in these areas and traded nationwide, they cannot be sold for use in these areas.

10.3.6.1.4 Caps on Credit Use

What Commenters Said:

Murphy commented EPA should not impose a 25 percent restriction on a refinery's non-highway baseline beginning June 1, 2008. The rationale for allowing small refiner relief may also apply to other refineries that do not qualify as approved small refiners. Further, Murphy stated that there is no economic or environmental justification for limiting the ability of refiners to use the full flexibility provided by the nonroad diesel credit trading system, and it would be unfair to do so.

Letters:
Murphy Oil, OAR-2003-0012-0212 p. 3

Our Response:

Although we took comment on such restrictions, we did not include them in our proposed regulations. The information we have received in response to the proposal has not altered our original views. Therefore, we have elected not to finalize any such restrictions on the use of credits.

10.3.6.2Labeling

What Commenters Said:

API, ExxonMobil, and Marathon commented that they support the proposed pump labeling provisions. It will be important for retailers to clearly indicate to the consumer what fuels are available for highway and nonroad use. The pump labeling requirements are complex but necessary, and can be adopted into weights and measures guidelines and laws.

Letters:
American Petroleum Institute, OAR-2003-0012-0804-0808 p. 21
ExxonMobil, OAR-2003-0012-0616 p. 22
Marathon Ashland, OAR-2003-0012-0826, 0827 p. 13

The Alaska Department of Environmental Conservation commented that EPA should clarify the labeling provisions. The label required under Section 80.590(a)(5)(v)(A) to identify fuel exceeding 500 ppm is confusing because the label calls the fuel "nonroad...diesel fuel" but then states the fuel is "Not for use in nonroad engines." At this point in the regulatory timeline, it seems that high sulfur fuel can be used in nonroad equipment only in emergencies, hardships, and small refiner exemptions.

Letters:
Alaska Department of Environmental Conservation, OAR-2003-0012-0607 p. 3

The Alaska Department of Environmental Conservation also commented that the labeling provisions outlined in the proposed rule will not work well in Alaska. Labels should reflect that Alaskan fuel is dye free and should describe 15 ppm fuel as appropriate for all diesel sources at any time. Alaska labels should describe appropriate sulfur levels in fuel by use and source type depending on the date. The labels should be fuel specific and good for all 2007 and later dates. EPA's proposed labeling provisions are problematic for Alaska since they are designed to change in 2007, 2010 and in 2014.

Letters:
Alaska Department of Environmental Conservation, OAR-2003-0012-0607 p. 3

Our Response:

Fuel pump labeling provisions are critical for the successful implementation of the engine standards in the final rule to help avoid misfueling. Given the complexity of the program finalized with the multiple grades of fuel at different timeframes, the pump labels also tend to be complex in that they must change with time. Nevertheless, we have made every attempt to make them as appropriate and understandable as possible for their intended purpose.

The pump labeling provisions finalized in today's rule should work well in Alaska. The label for 15 ppm highway diesel fuel states that it recommended for use in all diesel vehicles and engines. We do not believe that it is necessary for the pump label to indicate that the fuel is dye free since this is not pertinent to the use restrictions associated with the engine and fuel standards in today's rule. We believe that it is necessary for the labels to change with the implementation dates of the various stages of the engine and fuel sulfur standards in today's rule. It would be too confusing to the end-user to have temporary-dependent restrictions contained on a single fuel label that would be good for 2007 and later dates. We believe that this would contribute to increased instances of misfueling. We also allow for changes to the labels as necessary to reflect Alaska's non-dye status as provided in part §69.52.

10.3.6.3Reg Issues

10.3.6.3.1 Prohibitions on Certain Sales of Heating Oil

What Commenters Said:

NPRA commented that EPA should allow for the sale of heating oil for nonroad use at some point following promulgation of the rule. The proposed prohibition regulations at Section 80.610(a)(4) and (5) do not include a start date. For some period of time after promulgation, it should be legal to sell, offer for sale, etc. heating oil for use in nonroad, locomotive or marine engines and locomotive and marine diesel fuel for use in nonroad engines.

Letters:
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 24

Our Response:

The omission of a start date in the proposal for the cited regulatory prohibitions was an error. The final rule includes a start date.

10.3.6.3.2 Regulatory Provisions Deemed Superfluous or Illegal

FHR commented that section 80.610 (Cause another party to violate) is unnecessary. This would either be a duplication of a violation under other parts of the section or an unreasonable expectation that those performing otherwise legal activities are somehow responsible for the actions of others.

Letters:
Flint Hills Resources, OAR-2003-0012-0667 p. 9

FHR also commented that EPA does not have the authority to promulgate Section 80.612(a)(5) on Parent Corporation.

Letters:
Flint Hills Resources, OAR-2003-0012-0667 p. 9

Our Response:

It has always been the Agency's intention that parties in the fuel distribution system that cause another party to violate a standard would be held liable for such actions. The proposed provision at 80.610(e) is not intended to be duplicative, but rather to clarify liability that may not be clear from other regulatory provisions. The regulatory language in our proposal was in fact included in previous final rules. See section V.H of the preamble for more discussion.

Regarding Section 80.612(a)(5) on Parent Corporation, EPA does have authority to impose vicarious or presumed liability, if we provide reasonable opportunity to rebut such presumptions. Our regulations contain appropriate affirmative defenses that a parent corporation may employ. The regulations have been finalized as proposed.

10.3.6.4Fuel Mixing Provisions

What Commenters Said:

The Alaska Department of Environmental Conservation commented that it supports the proposed fuel mixing provisions. The provisions in Section 69.52(c)(1) - (3) allow Alaska to mix vehicle and off-road fuels if both meet sulfur/cetane/aromatic requirements for the on-road fuel. Most distributors prefer not to segregate, which implies that 15 ppm sulfur diesel is likely to be the predominant fuel imported.

Letters:
Alaska Department of Environmental Conservation, OAR-2003-0012-0607 p. 3

Our Response:

We agree with Alaska's comments and as such, we will be finalizing this provision in today's action.

10.3.6.5 Test Movements and Early Distribution Will Be Critical to Successful Rule Implementation

What Commenters Said:

AOPL commented that pipelines need experience moving the more sensitive products that will be created as a result of the proposed nonroad rule before they can determine the specifications they will require their shippers to meet. EPA should encourage refiners and importers to tender 15 ppm diesel for test movements on pipelines. Without this experience, the possibility of contamination and supply disruptions at the time of rule implementation is high. Even though EPA offers early credit to refiners for production of 15 ppm sulfur diesel to be used with specialized engines, most of the markets able to use 15 ppm sulfur diesel in specialized fleets are not pipeline accessible. EPA should develop a different mechanism, perhaps a more flexible credit program, to encourage this necessary testing of the distribution system to ensure a smooth transition in 2006 and 2007.

Letters:
Association of Oil Pipelines, OAR-2003-0012-0609 p. 23-24

Our Response:

In the context of this final rule, pipelines will not need test movements of 15 ppm NRLM fuel since they will have already had experience with 15 ppm highway diesel fuel. Thus this issue is not directly relevant for this final rule.

10.4 Other Refiner Issues

What Commenters Said:

West Harlem Environmental action commented that it is important to ensure that the process of reducing sulfur in diesels does not create an excuse to increase toxic emissions at oil refineries where diesel is produced.

Letters:
New York Public Hearing, A-2001-28, IV-D-05 [W. Harlem Environmental Action p. 262]

Our Response:

The process of desulfurizing diesel fuel will impact refinery operations in a way that could impact emissions (e.g. more process heaters). However, refiners will need to take this into account in the design of their desulfurization units such that they still comply with their applicable refinery emission limits.

11. ADMINISTRATIVE AND PROCEDURAL REQUIREMENTS (UMRAA, APA, PRA, etc.)

What We Proposed:

The comments in this section correspond to Section IX of the NPRM, and therefore deal with administrative and procedural rulemaking requirements. Further, this section deals mainly with comments surrounding EPA's Small Business Regulatory Enforcement Fairness Act (SBREFA) process, as we did not receive comments on our other administrative and procedural requirements. A summary of the comments received, as well as our responses to those comments are located below. Please note that this section deals only with comments on the general SBREFA process. Comments on specific aspects of the provisions proposed for small engine/equipment manufacturers and small refiners/fuel marketers can be found in chapters 9 and 4, respectively, of this Summary and Analysis document. For the full text of comments summarized here, please refer to the public record for this rulemaking.

11.1 SBREFA

11.1.1 SBREFA Process

What Commenters Said:

Some small refiners commented that the SBREFA process in this rulemaking was very effective. These refiners believe that the recommendations of the SBREFA panel outlined a fair and reasonable approach. Further, the ad-hoc coalition of small refiners commented that the SBREFA panel reviewing the impact of nonroad diesel alternatives on small business refiners was well informed and comprehensive in its approach. They also stated that "at this stage of fuel desulfurization regulation, the flexibilities that might be available to small business are greatly limited by engine technology, constraints imposed by the distribution system and issues of market supply and demand. In spite of those severe limitations, small refiners believe that the SBREFA panel recommendations outlined a fair and reasonable approach."

Letters:
Countrymark Cooperative, Inc., OAR-2003-0012-0602 p. 2
New York Public Hearing, A-2001-28, IV-D-05 [Gary-Williams p. 66]
Small Refiners Coalition, OAR-2003-0012-0754 p. 1-2

Our Response:

We appreciate and agree with the comments provided by these small refiners.

11.1.2 Regulatory Flexibility Act

What Commenters Said:

The Small Business Administration's Office of Advocacy (SBA Office of Advocacy) commented that EPA possesses regulatory discretion under the CAA to comply with the requirements of the

Regulatory Flexibility Act. They cited Section 213(a)(3) and (a)(4) as authorizing EPA to regulate nonroad diesel NO_x and PM emissions respectively. However, they stated, this is unlike (a)(3) which directs that EPA "shall" promulgate regulations for NO_x, (a)(4) states that EPA "may promulgate …such regulations as the Administrator deems appropriate." Further, they added, in this context, EPA possesses the statutory discretion to apply emissions standards that minimize negative economic impacts on small businesses, and therefore, should adopt one of the less burdensome alternatives, options 5a or 5b, as recommended by the one Panel member (SBA Office of Advocacy).

SBA Office of Advocacy also commented that we should exclude smaller engines from further regulation in order to comply with the Regulatory Flexibility Act. They believe that we did not demonstrate that regulation of small engine classes is necessary, stating that the incremental benefits of regulating engines below 75 hp do not justify the costs imposed on small businesses and that we have not demonstrated that engines below 75 hp contribute significant amounts of PM emissions to the national pollution inventory. SBA Office of Advocacy further stated that we indirectly provided PM emissions reduction data for the various options for only a few of the 25 years the RIA covers. SBA Office of Advocacy provided additional discussion on this issue (see attachments to their public comments), including tables that compare the costs, cost savings, and emission reductions of the proposed rule and recommends that EPA minimize small business impacts by adopting a final regulatory option that does not include a requirement for PM aftertreatment on engines below 75 hp.

SBA Office of Advocacy suggested that we address significant alternatives which would have the effect of minimizing the regulatory burden on small entities. They stated that during the SBREFA Panel process two regulatory alternatives were identified that SBA Office of Advocacy believed would significantly reduce small equipment manufacturer burdens - options 5a and 5b, both of which would exempt engines below 75 hp from aftertreatment requirements. SBA Office of Advocacy believes that EPA should minimize small entity burdens by adopting either Option 5a or 5b. They further stated that the information developed during the exhaustive SBAR Panel process supports the adoption of these alternatives since the incremental benefits of requiring aftertreatment for smaller engines do not justify the large differences in cost, since EPA has not demonstrated the technical feasibility of aftertreatment technology for nonroad diesel engines below 75 hp, and since small entities will bear an unfair and disproportionate share of the economic costs if standards are imposed on these smaller engines. SBA Office of Advocacy believes that EPA should adopt either Option 5a or 5b in order to minimize burdens on small entities pursuant to the RFA and the President's Executive Order 13272.

Letters:
U.S. Small Business Administration Office of Advocacy, OAR-2003-0012-0815 - 0818 p. 9-11

Our Response:

In response to SBA Office of Advocacy’s comments regarding the Regulatory Flexibility Act, we believe that the standards which we are finalizing today are appropriate and that the regulatory alternatives (or, transition provisions) which we are adopting will decrease the burdens on small entities consistent with the requirements of the Clean Air Act. Further, the feedback that we have received from small entities has shown that these entities generally believe that the transition provisions being finalized (which provisions go largely unmentioned in the comment) provide adequate lead time for the standards, and help to assure the reasonableness of the cost of the standards.

In response to SBA Office of Advocacy's comments regarding engines of 75 hp and lower, we are not adopting standards based on performance of NOx aftertreatment technologies for engines under 75 hp. The commenter raised two issues regarding the aftertreatment-based standards for PM for these engines: whether the standards are feasible, and whether the emissions reductions attributable to those standards are inappropriate in light of the costs to be incurred. We are responding to these comments in chapter 3 of this Summary and Analysis, and we discuss the feasibility of the PM standards for these engines in Chapter 4 of the RIA, in sections 4.1.4.3.2.1 and 4.1.5.3. Additionally, we address the issue of the costs associated with this category of engines in section 5.3.2 of the Summary and Analysis of Comments, as well as in preamble section VI.C. We summarize some of these responses below.

In sum, for the reasons stated in Chapter 4 of the RIA, we do not believe that there are any significant issues presented regarding technical feasibility of the standard. Nor have engine manufacturers themselves raised any such claims. Regarding the commenter's assertion that the costs of PM control for these engines is disproportionate to the PM emission reductions from these controls, see response to comment 3.1.4.3 in the Summary and Analysis of Comments, and EPA's detailed response to this issue presented in the proposal at sections 12.5.7, 12.5.8, 12.6.2.2.9, and 12.6.2.2.10 of draft RIA chapter 12, where we conclude (and reiterate here) that not only are the costs of PM control for these engines reasonable, but that the commenter's preferred alternative of no additional PM standards for these engines is legally impermissible. For unknown reasons, the commenter did not address any of this analysis in its comments. The costs presented by SBA Office of Advocacy also do not reflect any savings that are expected to occur because of the engine ABT program, the equipment manufacturer transition program (TPEM), or the 3 year program delay provided specifically to small volume engine companies, as discussed in the preamble section III .C.

While we have referenced the relevant analysis and responses to comment which support our decision to finalize the 2013 aftertreatment-based PM standards for engines in the 25-75 hp category above, we present here a brief summary of the rationale for our decision. The 2013 PM standards for engines in the 25-75 hp are clearly appropriate under the Clean Air Act, and, given the provisions of the Act (Section 213(a)(4)) and the available information, for EPA to do anything other than finalize these standards would be inappropriate. As discussed in the rulemaking record, we have based these conclusions on a number of factors, including but not limited to:

- diesel particulate matter from these engines results in a number of health and welfare concerns for the public (in particular for the 25-75 hp engines, which are generally used in smaller equipment where the operator is close to the engines' exhaust);
- the standards are clearly technically feasible in the 2013 time frame;
- EPA's detailed cost estimate and economic impact analysis indicates that the costs are reasonable, and does not show that any adverse impacts will occur for small (or other) businesses;
- the monetized benefits of control are far greater than the costs;
- as noted, the program includes a number of flexibilities for small volume engine and equipment companies, including an engine averaging, banking and trading program, three potential additional years of lead time for small volume engine companies and equipment

companies using those engines (which allows them to delay the 2013 PM standard until 2016), technical and economic hardship provisions for equipment companies (including small business equipment companies), replacement engine provisions for small equipment companies, and a temporary program for equipment manufactures (TPEM) which would allow small equipment companies to delay the introduction of the 2013 Tier 4 engines in some of their equipment for seven years (until 2020).

The commenter also urged that there be no new PM standards for engines under 25 hp. These comments were less focused (and raised no issues as to technical feasibility), but again essentially rested on the commenter's belief that the costs of such controls made PM standards for them inappropriate. Again, we disagree. See responses in draft RIA chapter 12 noted above. In addition, as discussed in Chapter 4 of the RIA, specifically section 4.1.5, we believe that the Tier 4 standards are feasible and the additional potential cost impact will not be as significant as some commenters may believe. A summary of the model year 2002 certification data for engines under 25hp is presented in Table 4.1-20n of this section of the RIA. The data are also shown in graphical form in Figure 4.1-20. These data indicate that some engine families already meet the Tier 4 PM standard (and the 2008 NMHC+NOx standard, unchanged from Tier 2). The current data indicate that approximately 28% of the engine families are already at or below the Tier 4 PM standard, while meeting the 2008 NMHC+NOx standard. These data reflect a range of certification test cycles, and include both IDI and DI engines. Many of the engine families are certified well below the Tier 4 standard while meeting the 2008 NMHC+NOx level, even without availability of low sulfur (500 ppm) diesel fuel. Specifically, 15 percent of the engine families are more than 20 percent below the Tier 4 PM standard. An additional 15 percent of the engine families already meeting 2008 NMHC+NOx standards will require no more than a 30 percent PM reduction to meet the 2008 PM standards.

We also disagree with some of the commenter's legal analysis. The Regulatory Flexibility Act, of course, cannot override requirements of substantive law, in this case, section 213 (a) (4) of the Clean Air Act. 5 U.S.C. section 606. Section 213 (a) (4) requires EPA to promulgate standards for a number of pollutants, including PM, which are "appropriate" considering costs, noise, safety, and energy factors associated with available technology. Thus, although EPA has some discretion in applying this provision (as the commenter points out), exercise of any such discretion cannot be arbitrary (Clean Air Act section 307 (d) (9)), and cannot result in standards which are inappropriate, after considering the requisite statutory factors. It is EPA's judgment not only that the standards for PM we are adopting for 75 hp engines are appropriate, but that standards that are not based on use of aftertreatment would be inappropriate within the meaning of section 213 (a) (4). Similarly, the Tier 4 PM standards for 0-25 hp engines are appropriate, and failure to adopt Tier 4 standards for these engines would be inappropriate, given these standards' feasibility at reasonable cost.

EPA also notes that we have taken into account the comments provided to us from small entities both during the SBREFA process and the public comment period, and we have also had discussions with engine and equipment manufacturers throughout the rule's development process. Accordingly, we believe that the provisions being finalized today address the concerns of these manufacturers (especially small business manufacturers) and will reduce the regulatory burden on small entities consistent with the substantive requirements of the Clean Air Act. In this regard, we reemphasize that as an aspect of providing adequate lead time, we have provided significant flexibilities to both engine makers and equipment manufacturers. It appears that the commenter did not take these flexibilities into account in making its comment. During the SBREFA process, some small business equipment manufacturers commented that they did not quite understand the provisions and/or that they were able to produce equipment without using the flexibilities and still comply with the regulations. We will be issuing a Small Entity Compliance Guide following the promulgation of this rule, which will help to clarify questions and problems that may arise for small business engine and equipment manufacturers.

11.2 Other Administrative and Procedural Requirement Issues

11.2.1 Clean Air Act

What Commenters Said:

EMA believes that EPA failed to provide due process of law under the CAA by failing to provide details or justification for many of its proposed requirements and programs within a reasonable timeframe. EMA further stated that EPA failed to do this for many key aspects of the NPRM, such as the alternate NTE provisions; and as a result, interested parties were prevented from commenting in a meaningful way. EMA cited CAA Section 307(d)(3); Ass'n of Nat'l Advertisers, Inc. v. F.T.C., 627 F.2d 1151, 1165-66 (D.C. Cir. 1979); Portland Cement Ass'n v. Ruckelshaus, 486 F.2d 375, 393 (D.C. Cir. 1973); and Global Van Lines v. ICC, 714 F.2d 1290 (5th Cir. 1983) as supporting documentation.

EMA also commented that EPA must establish a rational connection between the facts and the proposed requirements, and that our failure to do so will result in a rule that is arbitrary and capricious and in violation of CAA Section 307(d)(9)(A). EMA believes that there are numerous aspects to the rule that need to be deleted or revised, because they lack an adequate basis in fact or in the underlying data. EMA referred to its comments on specific sections of the proposed rule and adds that we must address each of those issues in order to provide a rational basis for the final rule. EMA also cited the following as supporting documentation for this rationale: Motor Vehicle Manufacturers Ass'n v. State Farm Mutual Automobile Ins. Co., 463 U.S. 29, 43 (1983) (citing Burlington Truck Lines, Inc. v. United States, 371 U.S. 156, 168 (1962)); Citizens to Preserve Overton Park v. Volpe, 401 U.S. 402, 413-14 (1971); Petroleum Communications, Inc. v. Federal Communications Commission, 22 F.3d 1164, 1172 (D.C. Cir. 1994); State Farm, supra, 463 U.S. at 43; and Central Arizona Water Conserv. Dist. v. EPA, 990 F.2d 1531, 1542 (9th Cir. 1993) (quoting State Farm, supra).

<u>Letters:</u>
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 107-109

Our Response:

Although EPA agrees that the commenter has accurately summarized these general legal principles, EPA disagrees that it provided inadequate notice for any of the provisions of the final rule, and further disagrees that any of the provisions lack rational support in the administrative record. With regard to adequacy of notice, moreover, EPA notes that it spent many hours in pre- and post-proposal meetings with this commenter, discussing essentially every point in its voluminous comments (including the alternative NTE, mentioned in this comment). EPA thus believes that it provided ample process. (EPA also notes that it is not adopting the alternative NTE in the final rule, so disputes regarding this provision are moot in any case.)

11.2.2 Public Hearings

What Commenters Said:

The American, Kansas, and Tennessee Farm Bureaus commented that EPA did not take farming concerns seriously, "evident by the lack of having a public hearing in a rural area."

Letters:
American Farm Bureau Federation, OAR-2003-0012-0608 p. 3
Kansas Farm Bureau, OAR-2003-0012-0825 p. 2
Tennessee Farm Bureau, OAR-2003-0012-0629 p. 2
(others repeated a similar concern)

Our Response:

The commenters are mistaken that EPA does not regard their concerns seriously (see, e.g., the separate analysis of impacts on agricultural application markets and agricultural producers and consumers found in Appendix C to chapter 10 of the RIA). While only one public hearing is held for the majority of EPA rules, we held public hearings in New York, Chicago, and Los Angeles in order to provide an opportunity for people in different regions of the country to provide oral comments. Moreover, the commenters may incorrectly believe that oral testimony at hearings carries special significance in the regulatory process. Many commenters availed themselves of the comment opportunities we afforded. We received over 180,000 written comments from the entire range of interested stakeholders, including farmers. As evidenced by the rulemaking documents, we seriously reviewed and addressed all comments of any significance.

12. OTHER ISSUES

What We Proposed:

The items raised in the following comments were not specifically proposed in the NPRM, and therefore have no general corresponding NPRM section.

12.1 Relationship to Other Mobile Source Sectors

12.1.1 Highway Diesel Rule

What Commenters Said:

API believes that the implementation of the highway diesel rule should have been timed to coincide more appropriately with the actual need for this fuel by new aftertreatment equipment vehicles. API commented that although many of the common-sense approaches EPA has proposed for the nonroad rule should help to mitigate additional adverse market impacts, API is concerned about the highway diesel rule and look forward to working with EPA and other stakeholders to achieve shared goal of a smooth implementation.

NRDC stated in their comments that the nonroad rule should not be used by EPA as a means to weaken or slow the implementation schedule for the highway diesel rule. NRDC also states that this issue has been resolved in the regulatory process, in the courts, and in the court of public opinion, and EPA should move ahead with implementation of the rule. Further, NRDC and others (ALA, Wisconsin DNR) commented that nothing in the nonroad diesel rule should weaken or undermine the highway rule or limit the supply of diesel. The commenters believe that if the nonroad rule maintains a two-step approach for the fuel sulfur standard, it is critical that EPA ensure an adequate supply of diesel fuel for both the highway and nonroad applications.

The American Trucking Association commented that it will be a challenge to phase-in 15 ppm highway diesel fuel in 2006 followed by the reduction of sulfur in nonroad diesel fuel to 500 ppm and 15 ppm in 2007 and 2010, respectively. The commenter stated that during this transition, EPA should work with U.S. Department of Energy to ensure that adequate supplies of both onroad and nonroad fuel are available, affordable, and in compliance with all applicable standards. The American Trucking Association also expressed concern that 15 ppm on-road diesel fuel may become contaminated and recommends that EPA take every effort to preserve the integrity of the on-road fuel supply.

Refiners are currently engineering systems to reduce highway diesel to 15 ppm sulfur by the mid-2006 deadline. API believes that it will be an additional challenge for refiners to significantly lower the sulfur level of nonroad diesel from as much as 5,000 ppm to 500 ppm only one year after this comprehensive change in refining and distribution operations.

Several commenters stated that the highway and nonroad fuel programs must be structured in such a way that refiners or importers cannot circumvent the 15 ppm limit in the highway rule simply by producing excess 500 ppm fuel and labeling it nonroad fuel, since the nonroad rule will require nonroad diesel to contain 500 ppm as of mid-2007.

One commenter (NPRA) expressed its concern with the supply impacts associated with the highway rule for a number of reasons. NPRA believes that the adverse effect of the highway rule on overall fuel supplies could be exacerbated by the nonroad rule. The commenter offered four points regarding this concern. First, short-term supply disruptions often follow the introduction of new fuels regulations. Implementation of the 1993 highway diesel (500 ppm) sulfur regulation led to supply disruptions for several months, and the CARB diesel program led to supply disruptions that lasted for more than a year. Supply disruptions may persist because the large capital investments and the time required to make significant refinery modifications do not permit quick increases in supply. Second, the U.S. refining industry may be reluctant to invest in desulfurization capacity following a prolonged period of low rates of return on capital investments, which compete with other investment needs such as NSR settlements. Third, average capacity utilization rates at U.S. refineries have increased over the past few years, but the industry's ability to increase domestic production has been exceeded by the growing demand for transportation fuels. Finally, NPRA stated that a significant portion of the nonroad diesel market uses low sulfur diesel today, which must continue to be produced to balance overall diesel demand and since ultra-low sulfur diesel will have lower energy content, slightly more must be supplied to provide the same transportation benefits as today's low sulfur diesel. Given these concerns, NPRA believes that the nonroad diesel sulfur regulation should include practical implementation requirements to mitigate any negative supply impacts.

NPRA also commented that the highway rule should be changed to allow a larger (10 or 15 percent) Temporary Compliance Option credit deficit carryover from the 2006 to 2007 compliance period, instead of the current cap of 5 percent. They believe that this would allow for more production and imports of low sulfur diesel in 2006, would contribute to additional diesel supplies, and would minimize short-term supply disruptions.

<u>Letters:</u>
American Trucking Association, OAR-2003-0012-0632 p. 3-4
Clean Air Task Force, et. al., OAR-2003-0012-0508 p. 20
Oregon Department of Environmental Quality, OAR-2003-0012-0779 p. 2
Pennsylvania Department of Environmental Protection, OAR-2003-0012-0699 p. 4
National Petrochemical & Refiners Association, OAR-2003-0012-0814 p. 6-7
Natural Resources Defense Council, et. al., OAR-2003-0012-0661, 0665 p. 34
Wisconsin Department of Natural Resources, OAR-2003-0012-0702, 0703 p. 3
STAPPA/ALAPCO, OAR-2003-0012-0507 p. 22
U.S. Public Interest Research Group, OAR-2003-0012-0780 p. 2
New York Public Hearing
A-2001-28, IV-D-05 [ALA p. 111; API p. 18-20; ATA p. 168; NRDC p. 34]

Our Response:

Comments on the highway diesel rule are beyond the scope of today’s rulemaking; however, we do not foresee implementation problems with the highway rule in relation to the promulgation of the nonroad rule, and have kept a close eye on the highway implementation process to assure that it is not jeopardized. As explained in detail in chapter II.A of the preamble, the lead times we have adopted for the engine standards are strongly influenced by the need to provide adequate time for the orderly implementation of these technologies in on-highway engines followed by orderly migration of the technologies to nonroad engines. In addition, the choice of a two-step fuel program for the nonroad rule is designed to assure that supplies of on-highway diesel fuel not be disrupted. See, e.g., 68 FR at 28463 and 28464 and draft RIA chapter 12.6.2.1.3.

This rulemaking is not being used as an attempt to sabotage the highway rule, and we do not believe that the provisions being finalized today will result in undermining the highway rule. As stated in the preamble, we are finalizing a two-step approach today; we will continue to work with members of the fuel industry, and other stakeholders, to ensure adequate supplies of fuel and a smooth implementation transition period.

We have provided a response to comments regarding the phase-in of highway diesel fuel in 2006 and the subsequent reductions in nonroad diesel fuel sulfur in 2007 and 2010 in section 4 of this Summary and Analysis of Comments. Refiners have already begun investigating systems to reduce the sulfur in highway diesel fuel and we believe that these technologies will proven out with sufficient time for refiners to begin desulfurization projects for nonroad diesel fuel. We believe that the designate and track approach that we are finalizing in today's program will eliminate the opportunity for refiners/importers to circumvent the highway diesel standards, minimize concerns about contamination, and will help to preserve the integrity of all fuels in the distribution system.

12.2 Alternative Fuels/Technology

What We Proposed:

The comments in this section do not necessarily correspond to the specific discussion of the alternative program options evaluated in Section VI of the NPRM, but they do relate to alternative fuel-based approaches to reducing emissions from diesel engines. A summary of the comments received, as well as our response to those comments are located below. For the full text of comments summarized here, please refer to the public record for this rulemaking.

What Commenters Said:

The New York Department of Environmental Conservation believes that EPA should promote programs to facilitate the electrification of those applications where connection to the electric grid is feasible, such as TRUs at loading docks, which could provide significant emissions reductions, particularly in highly impacted local areas.

We received several comments stating that EPA should consider promoting the use of biodiesel or vegetable oils. Biodiesel, a renewable fuel made from agricultural resources including soybean oil and other vegetable oils, animal fat, and recycled cooking oils, is a diesel fuel additive or substitute. Commenters believe that this alternative fuel could complement the goals and intent of the proposed low sulfur diesel fuel standard. Further, Griffin Industries and the National Biodiesel Board state that biodiesel's healthy emissions attributes, ultra low sulfate levels, and lubricity characteristics, could play a role in helping meet the standards set out by the proposed rule. B20 (20% biodiesel blended with 80% conventional diesel fuel) is capable of reducing total hydrocarbons, CO, and PM by up to 30%, 20%, and 15%, respectively. Even though NO_x emissions could be slightly reduced or increased, increases in NO_x can be effectively eliminated with the use of normal mechanical remediation techniques. Biodiesel is also capable of improving the effectiveness and durability of new aftertreatment devices for NO_x reduction.

Biodiesel can also help meet national goals for the net reduction of atmospheric carbon. As a renewable fuel derived from organic materials, biodiesel and blends of biodiesel reduce the net amount of carbon dioxide in the biosphere. Biodiesel production and use, in comparison to petroleum diesel, produces 78.5% less CO_2 emissions. In addition, Biodiesel can be used immediately and seamlessly as a clean-burning, no-sulfur alternative fuel or lubricity additive. In addition, use of biodiesel contributes to a longer equipment life, lower maintenance costs and less equipment downtime. Griffin also adds that extensive and credible engine emission test data incorporating biodiesel is readily available.

California Earth Corps commented that there is currently a plentiful supply of vegetable oils, which hopefully can ultimately be used as fuel in lieu of other conventional fuels such as diesel. And further, that this approach would reduce particulates and avoid the landfilling of these products.

Some commenters believe that we should evaluate incentives and opportunities for the increased use of biodiesel. These commenters stated that the use of biodiesel can be used to reduce sulfur levels and also to help engine lubricity; and increased usage could help address environmental issues and would also help grow the demand and use of agricultural crops, which could in turn help add to the economic viability of farmers if the price farmers receive for their crop increases as a result of the proposal. One commenter (Griffin) stated that passage of a comprehensive energy bill in 2003 will aid implementation of changes to diesel fuel used in off road applications through establishment of excise tax and blenders credits for biodiesel and that these economic considerations will allow markets for biodiesel to be more clearly defined economically and will lead to market size expansion. This commenter adds that the use of biodiesel will reduce our dependence on foreign oil and is the first and only alternative fuel to have successfully completed Tier 1 and 2 health effects testing.

The Oregon Wheat Growers League believes that the proposed rule is an excellent opportunity for EPA to examine the use of alternative fuels such as bio-fuels and bio-lubricants. These fuels are biodegradable and environmentally friendly. They also believe that, in the context of the proposed rule, the regulatory process is flawed since EPA failed to evaluate such a possibility.

Letters:
American Farm Bureau, OAR-2003-0012-0608 p. 3
Griffin Industries, OAR-2003-0012-0119 p. 1
Illinois Farm Bureau, OAR-2003-0012-0673 p. 2
Kansas Farm Bureau, OAR-2003-0012-0825 p. 2
Michigan Farm Bureau, OAR-2003-0012-0625 p. 2
National Association of Wheat Growers, et. al., OAR-2003-0012-0752 p. 2
National Biodiesel Board, OAR-2003-0012-0776 p. 2
Nebraska Farm Bureau, OAR-2003-0012-0514 p. 2
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 8
Oregon Wheat Growers League, OAR-2003-0012-0593 p. 2
Tennessee Farm Bureau, OAR-2003-0012-0629 p. 2
Los Angeles Public Hearing, A-2001-28, IV-D-07 [CEC p. 208]

Our Response:

There are a variety of efforts underway to promote the use of alternative technologies such as those mentioned. In the context of today's action setting new standards for nonroad diesel engines and off-highway diesel sulfur, however, alternative emission reduction strategies such as biodiesel, bio-based lubricants, or electric vehicles would be unlikely to enable the widespread use of the technologies required to meet the new standards. Even so, we recognize that use biodiesel might mitigate some of the lubricity concerns associated with ultra-low sulfur diesel fuel. Other potential benefits of biodiesel, such as reductions in emissions of certain pollutants or reductions in fossil fuel consumption, may be a factor in its use in specific circumstances.

12.3 Harmonization

What Commenters Said:

Many commenters believed that global alignment of nonroad emission standards would avoid unnecessary complexity and redundancy and would provide the most cost-effective emission reductions. They believe that EPA should recognize the international nature of the nonroad engine industry and should work with the European Union and Japan to facilitate the implementation of compatible nonroad standards; and stated that harmonization is not only the most cost-effective and efficient emissions reduction strategy, but it enables manufacturers to apply emissions reduction technologies across a wide range of product configurations, ensuring more efficient emissions reductions. These commenters all expressed the concern that if the U.S. emission standards are not aligned with other major nations, manufacturers may be forced to duplicate the development of engines to marginally different emission standards and test cycles.

MECA commented that EPA should harmonize the standards if possible, but should ensure that the emissions are based on the CAA mandate that those standards achieve the greatest possible emission reductions based on technological feasibility.

CNH Global added that EPA's Tier 4 regulation should be aligned with the European Commission Stage 3B regulation, since this is an essential requirement for achieving regulatory harmonization with Japan, Latin America, China, and India. Another commenter (AEM) noted that it is important that other regulations that will impact emission reductions such as the European Noise Directive, which is in place now and will become more stringent in a couple years, be taken into consideration. AEM provided additional discussion on this issue including a list of the following major areas of the proposed rule that will require alignment: the cutpoint of 75 hp (as opposed to 100 hp); the lack of an EU NO_x requirement or regulations for engines below 25 hp; the inconsistency between the Tier 2/3 EU PM limit in 2007 and the U.S. PM limit in 2008 for engines between 25 and 50 hp; EPA's reliance on compliance flexibility provisions, which are not recognized options in other regions of the world; emission testing procedures; and the introduction date for low sulfur diesel for the nonroad market. Ingersoll-Rand noted that this issue is particularly important in the context of the proposed rule, given the global nature of the nonroad rule and includes a list of specific differences that should be resolved between Tier 4 and EC's recent proposal.

CNH noted that provisions such as ABT, the 80% flexibility, phase-ins, and early introduction incentives make alignment very difficult. One of the main problems, they state, is a lack of understanding outside the U.S. of the proposed 25 percent and 50 percent NO_x after-treatment phase-in. They stated that EPA should clarify the averaging that is allowed by stating its equivalent NO_x level.

EMA also added that in Europe, amendments to NRMM Directive 97/68/EC establish particulate trap forcing standards only for engines over 37 kW. They state that if the disparity remains between EPA and EC regulation, engine and equipment manufacturers would have to design and introduce PM traps for a very limited market. EMA believes that EPA should use the technology review to harmonize standards for these smaller nonroad diesel engines so that engine and equipment manufacturers can focus their efforts on developing cost-effective emission control solutions and benefit from using the revenues and cost-spreading opportunities afforded by a worldwide market.

AEM believes that the lack of alignment between U.S. standards for nonroad equipment and those of other countries may have an adverse effect on the used equipment market. They add that U.S. nonroad machines equipped with advanced catalyst controls may find their way to Mexico and other countries that may not have low sulfur content diesel fuel, and these engines will have performance issues and additional warranty liability for the OEM if the emission control systems are irreversibly damaged by the prolonged use of high sulfur fuel. They suggest that EPA clarify what measures will be taken to evaluate and control the numbers of these machines returning into the U.S. used equipment market. Furthermore, the lack of alignment will discount the value of used equipment, since there will be fewer outlets for the sale of these used machines outside of the U.S.

The Clean Air Council stated that, in the future, EPA should consider following the European Union's lead in calling for the use of sulfur-free diesel fuel in nonroad vehicles.

Lastly, CEMA-CECE believes that EPA should provide an expert to help the EU review the proposal in detail, clarify portions of the rule that may be unclear, and resolve any other outstanding issues.

<u>Letters:</u>
American Road and Transportation Builders Association, OAR-2003-0012-0633 p. 2
American Trucking Association, OAR-2003-0012-0632 p. 6
Association of Equipment Manufacturers, OAR-2003-0012-0669, 0670 p. 6-7
CEMA-CECE, OAR-2003-0012-0598 p. 3-4
CNH Global, OAR-2003-0012-0819 p. 6
Caterpillar, Inc., OAR-2003-0012-0812 p. 2
Clean Air Council, OAR-2003-0012-0613 p. 3
Cummins, Inc., OAR-2003-0012-0650 p. 8
Engine Manufacturers Association, OAR-2003-0012-0656, 0657 p. 25
Ingersoll-Rand, OAR-2003-0012-0504 p. 7, 13
Komatsu, OAR-2003-0012-0455 - 0457 p. 4-5
Kubota, OAR-2003-0012-0620 p. 1-2
National Mining Association, OAR-2003-0012-0510 p. 2
Western Business Roundtable, OAR-2003-0012-0636 p. 4-5
New York Public Hearing
A-2001-28, IV-D-05 [Caterpillar p. 76; Deere p. 52; DTF p. 161; EMA p. 102; IR p. 227]
Los Angeles Public Hearing
A-2001-28, IV-D-07 [Cummins p. 35; EMA p. 155]
Chicago Public Hearing
A-2001-28, IV-D-06 [AEM p. 225; Caterpillar p. 60; CNH p. 65; EMA p. 31;

Euromot p. 231]

Our Response:

We agree that international harmonization of emissions limits and test procedures leads to an opportunity for a more efficient design process, and that the lower costs and other efficiencies that could result from such a process are relevant in assessing both standard-setting and lead time under section 213. Nonetheless, the critical issues remain determining the greatest emissions reductions feasible and the appropriateness of standards considering technology availability and other factors. See CAA section 213 (a) (3) and (4). We have, however, worked to effectively align emission limit values in the three major markets to which commenters have expressed the most interest. See preamble section II.A.8. We have initiated and continue to maintain a direct dialogue with government and industry representatives in Europe and Japan. Both Japan and Europe have Tier 3 / Stage III standards that closely match EPA's Tier 3 program.

The concerns raised by commenters regarding long-term standards focus on standards for the smallest of nonroad diesel engines (under 37 kW) and the largest nonroad diesel engines (over 560 kW). In addition, commenters expressed a desire to have long-term PM and NOx emissions aligned. Both Japan and Europe have deferred action on the long-term standards for nonroad diesel NOx emissions in the under 37 kW range; however, Europe has set long-term standards for particulate matter above 37 kW which match EPA's approach. Both Europe and Japan have articulated a strong desire to address the need for stringent long-term emissions standards.[55] [56] Long-term emission standards in the 56 to 560 kW power range in Europe and the United States are completely aligned for NOx and PM. This addresses many of the concerns raised by commenters regarding European Union (EU) / EPA alignment. The GRPE NRMM working group continues to provide an adequate forum for industry and government entities to share technical concerns and regulatory information related to testing challenges and technology.

We understand the commenters' concerns regarding the impact of global alignment on the cost-effectiveness of design changes. We have worked with other governments to achieve alignment. There remain additional future opportunities for complete alignment of standards. One commenter, the Association of Equipment Manufacturers (AEM) broached concerns related to European Noise regulations in the context of emission regulation alignment. Given the alignment achieved with the European Union, we suspect the technical challenges that may exist in Europe will be faced universally by manufacturers that choose to participate in that market. Given the move to long-term, near-zero emissions standards, many of the challenges that existed with older technology may be lessened with effective implementation of the control strategies needed to meet these standards. We do not expect our rulemaking to adversely impact the design process manufacturers will use to meet the noise regulations in Europe.

To provide clarity for all manufacturers on the alternative NOx standard to which they may certify during the phase-in years, we describe those alternative standards in the preamble section

[55] *Future Policy for Motor Vehicle Emission Reduction (Seventh Report);* July 2003; page 5 and *Future Policy for Motor Vehicle Emission Reduction (Sixth Report);* June 2003; Appendix; page 33

[56] European Directive 97/68/EC and European Directive 2004/26/EC

III.A.2.b, and have specifically defined them in § 1039.102 (e).

Lastly, with respect to equipment exported for use in markets which lack the appropriate fuel for the emissions control strategies expected to be employed for Tier 4, we will continue to monitor this issue. If we determine that such exported engines are being reimported with degraded emission controls, we will take appropriate steps, such as requiring engines exported to such markets to have their U.S. certification label removed prior to export to prevent the potential for those engines, once tampered with, to be imported at a later date into the United States. The extended misfueling that could result from an engine not being properly fueled is comparable to tampering with the emissions control systems for that certified product.[57]

12.4 Other Programs and Regulations

12.4.1 Regulations

What Commenters Said:

The New York DEC believes that EPA should revisit Category 3 Marine regulations, and set tighter standards for both the emissions standards and fuel sulfur. Further, they also state that EPA should promulgate aircraft exhaust emissions standards as well.

Letters:
New York Department of Environmental Conservation, OAR-2003-0012-0786 p. 8

Our Response:

We have committed to a 2007 rulemaking schedule to take action on the next round of emissions standards for Category 3 Marine applications. We are also investigating Sulfur Emission Control Areas (SECAs) for coasts.

In regards to aircraft standards, we note that promulgating aircraft exhaust emissions standards is beyond the scope of this rulemaking. However, there currently are proposed emission standards for aircraft, and EPA plans to continue to evaluate controlling aircraft emissions in the future.

12.4.2 Mitigation Fee Program

What Commenters Said:

SCAQMD suggested that EPA consider implementation of a mitigation fee program in the rulemaking. They state that this concept has already been incorporated in the 2003 AQMP as a control measure for EPA to consider implementing. We could develop such an option where fees would be paid into a fund in lieu of a more stringent standard or a more accelerated compliance schedule if such

[57] §1068.101 (b)(1)

standard or compliance schedule are deemed impossible. The revenues would be used by local districts to implement emission reduction projects and achieve equivalent reductions.

Letters:
South Coast Air Quality Management District, OAR-2003-0012-0623 p. 3, 6-7

Our Response:

The recommendation suggested by the commenter is outside the scope of this rulemaking. EPA would also note that it would raise serious legal issues concerning standard setting under section 213 of the Act and use of funds under the miscellaneous Receipts Act.

12.5 Miscellaneous

12.5.1 Use of Shore Power

What Commenters Said:

California Earth Corps commented that we should also consider promoting and facilitating the use of shore power by ships to reduce emissions in the port areas.

Letters:
Los Angeles Public Hearing, A-2001-28, IV-D-07 [CEC p. 208]

Our Response:

Under section 213 the Clean Air Act, EPA's authority is limited to setting emission standards for new nonroad engines and vehicles and related compliance requirements. However, several port areas, including those in Southern California, are exploring the feasibility of providing infrastructure to permit ships to use shore-side power while they are in port. The experience of these ports will be very valuable in helping other ports evaluate this option for their marine emission reduction plans. EPA will continue to follow these developments.

12.5.2 ARTBA Petition

What Commenters Said:

ARTBA commented that EPA should act on their petition that applies to the provisions for nonroad vehicles under Section 209(e) of the CAA. ARTBA filed a petition with EPA on July 12, 2002 asking EPA to amend its rules implementing the preemption provisions of the CAA, Section 209(e), applicable to nonroad vehicles. This petition requested that EPA amend 40 CFR 85.1603 and the interpretative rule published at 40 CFR Part 89, Appendix A to clarify that Section 209(e) preempts state and local emission control requirements that impose in-use and operational controls or fleetwide purchase, sale, or use standards on nonroad vehicles. They add that with the implementation of a new nationwide standard, it should be made clear that state and local standards are not permissible.

Letters:
American Road and Transportation Builders Association, OAR-2003-0012-0633 p. 2

Our Response:

We are still reviewing the issues raised in the ARTBA petition. These issues are not related to the specific regulatory changes that are the subject of this rulemaking and we have not examined these issues in the context of this action.

12.5.3 Involvement of a Neutral Party to Provide an Objective Evaluation of the Rule's Impact

What Commenters Said:

The National Mining Association commented that EPA should facilitate the involvement of a neutral party that could identify gaps in research and provide an objective evaluation of the rule's impact to industry. NMA noted that the National Institute of Occupational Safety and Health (NIOSH) has been the neutral party involved in the MSHA underground diesel rule, and has conducted the testing and evaluation of systems including costs and the cause and effects of emission controls on engine maintenance, efficiency and daily use in actual mining conditions. NMA stated that it believes that we should identify a neutral group that can function in a similar role as NIOSH has with the MSHA underground diesel rule.

Letters:
National Mining Association, OAR-2003-0012-0510 p. 2

Our Response:

We appreciate the commenter's concern, but this issue is beyond the scope of this rulemaking.

12.5.4 End-user Requirements

What Commenters Said:

ExxonMobil supports the proposed end-user requirements specified in the preamble.

Letters:
ExxonMobil, OAR-2003-0012-0616 p. 23

Our Response:

We agree that it is important to have requirements for end-user to ensure proper implementation of the fuel controls of today's program.

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3. Energy Information Administration, Department of Energy, "The Transition to Ultra-Low Sulfur Diesel Fuel: Effects on Price and Supply, May 2001.

4. FitchRatings, Special Report, "What a Smell of Sulfur!" Impact of the Low Sulfur Regulations on the U.S. Refining Sector, July1 2003.

5. Muse, Stancil and Co., "Alternate Markets for Highway Diesel Fuel Components," Prepared for Southwest Research Institute, Under Contract to U.S. EPA, September 2000.

6. David Harrison, Jr. and Randall Lutter, National Economic Research Associates, "Potential Impact of Environmental Regulations on Diesel Fuel Prices," Prepared for the Alliance of Automobile Manufacturers, December 2000.

7. Mathpro, Inc., "Prospects for Supply of Ultra Low Sulfur Diesel Fuel in the Transition Period (2006-2007), An Analysis of Technical and Economic Driving Forces for Investment in ULSD Capacity in the U.S. Refining Sector," Prepared for the Alliance of Automobile Manufacturers and the Engine Manufacturers Association, February 26, 2002.

8. "Summary and Analysis of the 2003 Highway Diesel Fuel Pre-Compliance Reports", EPA, October 2003.

9. National Petroleum Council, "The U.S. Refining Industry: Assuring the Adequacy and Affordability of Cleaner Fuels, June 2000.

10. State of Illinois, "Illinois EPA Urges Enforcement Action Against Premcor Blue Island Refinery For Catalyst Releases," June 20, 2000, Contact: Dennis McMurray, (217) 785-1871

11. Hardship provisions for: 1) Tier 2 gasoline standards (40 CFR 80.270), 2) 2007 highway diesel fuel program (40 CFR 80.560).

12. Letter to Mr. Emmett Barker, President, Equipment Manufacturers Institute, from Chester France, Director, Engine Programs and Compliance Division, EPA, February 26, 1998, EDOCKET OAR-2003-0012-0957.

13. "Summary and Analysis of Comments: Control of Emissions from Nonroad Diesel Engines" U.S. EPA, August 1998, pages 74-76, EDOCKET OAR-2003-0012-0958.

14. See our website at www.epa.gov/otaq/diesel.htm#engineworkshops which contains a link to the presentation made by Steve Duley of Schneider Trucks.

15. "Manufacturers of Emission Control Association Report on Agreed-Upon Procedures," March 23, 2004, EDOCKET OAR-2003-0012-0928.

16. "International Truck Presentation 2004 Diesel Summit II", presented by Patrick Charbonneau," slides 15 and 17, EDOCKET OAR-2003-0012-0929.

17. "Information from John Deere regarding Oil Change Intervals for Nonroad Uncontrolled, Tier 1, and Tier 2 Engines," memorandum from William Charmley to Air Docket A-2001-28, March 17, 2004, Docket Item IV-E-41.

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19. Regulatory Impact Analysis: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements, Assessment and Standards Division, Office of Transportation and Air Quality, U.S. EPA, EPA420-R-00-026, December 2000.

20. Regulatory Impact Analysis - Control of Air Pollution From Motor Vehicles: Tier 2 Motor Vehicle Emission Standards and Gasoline Sulfur Control Requirements, Engine Programs and Compliance Division, Office of Mobile Sources, U.S. EPA, EPA420-R-99-023, December 1999.

21. Petroleum Refining Technology and Economics, Fourth Edition 2001, Handwerk, Glenn E., Gary, James H., page 363, Table 18.1.

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