Summary and Analysis of Comments: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder

United States
Environmental Protection
Agency

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

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Commenter	Abbreviation	Docket ID Number
Aabenraa Motorfabrik		OAR-2003-0190-0549—0549.3
Alexander/Ryan Marine & Safety Co.		OAR-2003-0190-0661
American Lung Association	ALA	OAR-2003-0190-0592.1[1], 0728[2], (hearing: OAR-2003-0190-0509)
American Lung Association of the Northwest	ALA	(hearing: OAR-2003-0190-0482)
American Lung Association of Metropolitan Chicago		(hearing: OAR-2003-0190-0518)
American Short Line Railroad Association	ASLRRA	OAR-2003-0190-0560.1
American Waterways Operators	AWO	OAR-2003-0190-0574.1, 0725 (reman) (hearing: OAR-2003-0190-0519)
Argillon LLC		(hearing: OAR-2003-0190-0515, 0515.1)
Association of American Railroads	AAR	OAR-2003-0190-0566.1 (hearing: OAR-2003-0190-0479, 0510)
ASTM International		OAR-2003-0190-0464, 0465
Baylink Ferry/City of Vallejo		OAR-2003-0190-0581, 0581.1
Bollinger Shipyards Lockport, LLC		(hearing: OAR-2003-0190-0520)
California Air Resources Board	CARB	OAR-2003-0190-0596.1, 0719 (duplicate)
Carolinas Clean Air Action		OAR-2003-0190-0592.1[1]
Caterpillar, Inc.		OAR-2003-0190-0580.1, 0591.1 (hearing: OAR-2003-0190 -0485, -0498)
Chromium Corporation		OAR-2003-0190-0651
CIMAC (Intl. Council on Combustion Engines)		OAR-2003-0190-0548.1
Citizen Action Illinois		OAR-2003-0190-0592.1[1]
Citizens for Pennsylvania's Future	PennFuture	OAR-2003-0190-0592.1[1]
Clean Air Task Force	CATF	OAR-2003-0190-0592.1[1], (hearing: OAR-2003-0190-0499)
Clean Air Watch		OAR-2003-0190-0592.1[1], 0728[2], (hearing: OAR-2003-0190-0500)
Clean Water Action (National, MA, CT, PA, RI)		OAR-2003-0190-0592.1[1]
Coalition of Aftermarket Rail and Marine Engine Suppliers	CARMES	OAR-2003-0190-0650
Columbia River Gorge Commission		OAR-2003-0190-0516

[1] Comment OAR-2003-0190-0592.1 was jointly submitted.
[2] Marine remanufacturing comments OAR-2003-0190-0728 were jointly submitted by the American Lung Association, Clean Air Watch, Environmental Defense, and Natural Resources Defense Council.

Commission Centrale pour la Navigation du Rhine	CCNR	OAR-2003-0190-0715
Crowley Maritime Corporation		EPA-HQ-OAR-2003-0190-0641, 0659 (*duplicate*)
Cummins, Inc.		OAR-2003-0190-0559.1, 0653 (*duplicate*), 0731 (*reman*), (hearing: OAR-2003-0190-0501)
Department of Defense (DoD) Clean Air Act Services Steering Committee	CAA SSC	OAR-2003-0190-0568.1
Electro-Motive Diesel, Inc.	EMD	OAR-2003-0190-0594.1-0594.4, 0662, Reman: 0729, (hearing: OAR-2003-0190-0502)
Elliot Bay Design Group		(hearing: OAR-2003-0190-0486)
Engine Manufacturers Association	EMA	OAR-2003-0190-0569.1, 0570.1, 0571.1, 0575.1, 0577.1, 0578.1, 0582.1, 0584.1, 0585.1, 0586.1, 0587.1; Reman: 0726, 0727, 0733; (hearing: OAR-2003-0190-0503, 0545)
Environmental Club of Colorado State University-Pueblo		OAR-2003-0190-0466
Environmental Defense		OAR-2003-0190-0592.1[1], 0610-0610.3, 0728[2], 0735, C3 comments: -0638 (hearing: OAR-2003-0190-0487, 546, 0546.1)
Environment Northeast		OAR-2003-0190-0592.1[1]
Fr. Fassmer GmbH & Co., Germany		OAR-2003-0190-0477
Friends of the Earth		OAR-2003-0190-0609
General Electric Transportation	GE	OAR-2003-0190-0590.1
Group Against Smog and Pollution		OAR-2003-0190-0592.1[1]
Horiba (*labeled as private citizen M. Akard*)		OAR-2003-0190-0602
(City of) Houston Department of Health & Human Services		OAR-2003-0190-0561.1
Johnson Matthey		(hearing: OAR-2003-0190-0488)
Kaydon Ring and Seal, Inc		OAR-2003-0190-0654
Kern County Board of Supervisors		OAR-2003-0190-0724
Kim Hotstart Manufacturing Co.		OAR-2003-0190-0588.1
Kirby Corporation	Kirby	OAR-2003-0190-0563.1
Lake Carriers' Association	LCA	OAR-2003-0190-0567.1
Lat-Lon LLC		OAR-2003-0190-0481
Makah Tribal Council		OAR-2003-0190-0472
Manufacturers of Emission Controls Association	MECA	OAR-2003-0190-0572, 0572.1, Reman: 0730, (hearing: OAR-2003-0190-0494, -0504)
Marathon Petroleum Company		OAR-2003-0190-0595.1

Markle Marine Safety Services		OAR-2003-0190-0547, 0547.1
Marine Propulsion Technology, Inc. (*w/ PurePower*)		OAR-2003-0190-0720
MIRATECH Corporation		(hearing: OAR-2003-0190-0505)
Missouri Department of Natural Resources	MDNR	OAR-2003-0190-0658
MotivePower, Inc.		OAR-2003-0190-0613
MTU Detroit Diesel Corporation, Inc.	MTU	OAR-2003-0190-0573.1
National Association of Clean Air Agencies	NACAA	OAR-2003-0190-0579.1, 0732 (*reman*), (hearing: OAR-2003-0190-0495, -0511)
National Maintenance & Repair, Inc		OAR-2003-0190-0655
National Marine Manufacturers Association	NMMA	OAR-2003-0190-0656 (hearing: OAR-2003-0190-0513, 0513.1)
National Park Service- Pacific West Region		OAR-2003-0190-0480 (hearing)
Natural Resources Defense Council	NRDC	OAR-2003-0190-0592.1, OAR-2003-0190-0728[2], (hearing: OAR-2003-0190-0489, -0606)
New Jersey Department of Environmental Protection	NJDEP	OAR-2003-0190-0562.1—0562.3
New Jersey Environmental Federation		OAR-2003-0190-0592.1[1]
New York State Department of Environmental Conservation	NYDEC	OAR-2003-0190-0583, 0583.1
North Carolina Department of Air Quality	NCDAQ	OAR-2003-0190-0565.1
North Kingston Community Association		(hearing: OAR-2003-0190-0496)
Northeast States for Coordinated Air Use Management	NESCAUM	OAR-2003-0190-0551.1 (hearing: OAR-2003-0190-0512)
Northwest Environmental Defense Center		OAR-2003-0190-0593.1—0593.2
Offshore Marine Service Association	OMSA	OAR-2003-0190-0611.1 (hearing: OAR-2003-0190-0490, 0490.1)
Oregon Department of Environmental Quality	ODEQ	(hearing: OAR-2003-0190-0506)
Oregon Environmental Council		OAR-2003-0190-0652
Overseas Shipholding Group	OSG	OAR-2003-0190-0589.1
Ozone Transport Commission	OTC	OAR-2003-0190-0633.1
Passenger Vessel Association	PVA	OAR-2003-0190-0576—0576.2 (hearing: OAR-2003-0190-0507)
Peninsular Engines, Inc.		(hearing: OAR-2003-0190-0491)
People for Puget Sound		OAR-2003-0190-0649
Port of Seattle		(hearing: OAR-2003-0190-0469, 0469.1, 0497)
Public Citizen Texas Office		OAR-2003-0190-0592.1[1]
Puget Sound Clean Air Agency		(hearing: OAR-2003-0190-0484)

Pure Power EcoFuel, LLC (*w/ MPT, Inc.*)		OAR-2003-0190-0720
Railpower Hybrid Technologies Corp.		(hearing: OAR-2003-0190-0492)
Rail World, Inc.		OAR-2003-0190-0474
Respiratory Health Association of Metropolitan Chicago		OAR-2003-0190-0592.1[1]
San Joaquin Valley Unified Air Pollution Control District		OAR-2003-0190-0556.1
Seaport Air Quality Program, Port of Seattle		OAR-2003-0190-0469
Southwest Clean Air Agency		OAR-2003-0190-0468, (hearing: OAR-2003-0190-0508, 0508.1)
South Coast Air Quality Management District	SCAQMD	OAR-2003-0558.1 (hearing: OAR-2003-0190-0483, 0483.1, 0493)
Survival Systems International		OAR-2003-0190-0657
Sustainable Energy and Economic Development Coalition	SEED	OAR-2003-0190-0592.1[1]
Tacoma Public Utilities		(hearing: OAR-2003-0190-0517)
Teleflex EcoTrans Technologies		OAR-2003-0190-0553.1, 0554.1
Texas Commission on Environmental Quality	TCEQ	OAR-2003-0190-0612.1, 0660 (*duplicate*)
Tidewater Marine		OAR-2003-0557, 0557.1 (hearing: OAR-2003-0190-0514)
U.S. Coast Guard		OAR-2003-0190-0721
U.S. Marine Safety Association	USMSA	OAR-2003-0190-0617, 0617.1
U.S. Public Interest Research Group	U.S. PIRG	OAR-2003-0190-0592.1[1]
Washington State Department of Transportation	WSDOT	OAR-2003-0190-0555.1-0555.2[3]
Washington State Ferry System	WSF	OAR-2003-0190-0555.1-0555.2[3]
Wisconsin Department of Natural Resources	WDNR	OAR-2003-0190-0552
Wyoming Outdoor Council		OAR-2003-0190-0467
ZTR Control Systems		OAR-2003-0190-0564.1

[3] Comments OAR-2003-0190-0555.1 and OAR-2003-0190-0555.2 were jointly submitted by the Washington State Ferry System and the Washington State Department of Transportation.

LIST OF ACRONYMS

AAPA	American Association of Port Authorities
ABS	American Bureau of Shipping
ABT	Averaging, Banking, and Trading
AECC	Association for Emissions Control by Catalyst
AECD	Auxiliary Emission Control Device
AESS	Automatic Engine Stop/Start
ANPRM	Advance Notice of Proposed Rulemaking
API	American Petroleum Institute
APU	Auxiliary Power Unit
ASTM	American Society for Testing and Materials
AQCD	Air Quality Criteria Document
AQMP	Air Quality Management Plan
bpcd	Barrels per Calendar Day
C1	Category 1 (*marine diesel engines with capacity of 7 liters per cylinder or less; used to power vessels such as tugboats, fishing vessels, and other commercial vessels in and around U.S. ports, or as stand-alone generators for auxiliary electrical power on many types of vessels*)
C2	Category 2 (*marine diesel engines with an engine capacity over 7 liters per cylinder but less than 30 liters per cylinder; used to power vessels such as tugboats, fishing vessels, and other commercial vessels in and around U.S. ports, or as stand-alone generators for auxiliary electrical power on many types of vessels*)
C3	Category 3 (*marine diesel engines with per-cylinder displacement at or above 30 liters; very large marine diesel engines used on ocean-going vessels such as container ships, oil tankers, and cruise ships*); also called “ocean-going vessels”
CAA	Clean Air Act
CARB	California Air Resources Board
CASAC	Clean Air Science Advisory Committee
CDPF	Catalyzed Diesel Particulate Filter
CFR	Code of Federal Regulations
CI	Compression Ignition
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COPD	Chronic Obstructive Pulmonary Disease
CPP	Controllable Pitch Propeller
CVS	Constant Volume Sampler
DC	Direct Current
DDHS	Diesel Driven Heating System
DF	Deterioration Factor
DOC	Diesel Oxidation Catalyst
DoE, DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation

DPF	Diesel Particulate Filter
DPU	Distributed Power Unit
DRIA	Draft Regulatory Impact Analysis
ECM	Engine Control Module
EGR	Exhaust Gas Recirculation
EEZ	Exclusive Economic Zone
EIA	Economic Impact Analysis
EIA	(DOE's) Energy Information Administration
E.O.	Executive Order
EPA	U.S. Environmental Protection Agency
ERC	Emission Reduction Credits
ESC	European Stationary Cycle
ETC	European Transient Cycle
EU	European Union
F	Frequency Factor
FEL	Family Emissions Limit
FR	Federal Register
FRA	Federal Railroad Administration
FRM	Final Rulemaking
G	Gravitational Constant
g/bhp-hr	Grams per brake horsepower-hour
g/kW-hr	Grams per kilowatt-hour
GHG	Greenhouse Gas
GPS	Global Positioning System
GSM	Global System for Mobile Communications
H_2S	Hydrogen Sulfide
HAD	Health Assessment Document
HC	Hydrocarbon
HD	Heavy Duty
HDOH	Heavy Duty On-Highway
HDV	Heavy-duty Vehicle
HEP	Head End Power
HEPA	High-Efficiency Particulate Air
HP, hp	Horsepower
HPD	High Power Density
HRA	Health Risk Assessment
Hz	Hertz
IEEE	Institute of Electrical Engineers
IM, I/M	Inspection and Maintenance
IMO	International Maritime Organization
INTERTANKO	International Association of Independent Tanker Operators
ISO	International Organization for Standardization
kW	Kilowatt
L/cyl	Liters per cylinder
LDV	Light-duty Vehicle

LEV	Low Emission Vehicle
LM	Locomotive and Marine Diesel Fuel
LMOA	Locomotive Maintenance Officers Association
LNG	Liquefied Natural Gas
LSD	Low Sulfur Diesel
LTR	Limited Testing Region
MARPOL	International Convention for the Prevention of Pollution from Ships
MIL	Malfunction Indicator Light
MOU	Memorandum of Understanding
MY	Model Year
NAAQS	National Ambient Air Quality Standard
NH_3	Ammonia
NMHC	Non-methane Hydrocarbon
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NOx	Oxides of Nitrogen
N_20	Nitrous Oxide
NPRM	Notice of Proposed Rulemaking
NPV	Net Present Value
NRLM	Nonroad, Locomotive, and Marine diesel fuel
NTE	Not-to-Exceed
O_3	Ozone
OBD	On-board Diagnostics
OEM	Original Equipment Manufacturer
OGV	Ocean-going Vessel
OMB	Office of Management and Budget
OSV	Off-shore Support Vessel
OTAQ	Office of Transportation and Air Quality
PFD	Partial-Flow Dilution
PGM	Platinum Group Metals
PLT	Production Line Testing
PM	Particulate Matter
PM_{10}	Particulate Matter 10 microns in diameter or less
$PM_{2.5}$	Particulate Matter 2.5 microns in diameter or less
ppm	Parts per Million
R&D	Research and Development
RCL	Remote-controlled Locomotive
RFA	Regulatory Flexibility Act
RIA	Regulatory Impact Analysis
ROG	Reactive Organic Gas
ROI	Return on Investment
SAB	Science Advisory Board
SAB-HES	Science Advisory Board Health Effects Subcommittee
SAE	Society of Automotive Engineers
SAPS	Sulfated Ash, Phosphorus, and Sulfur

SBA	Small Business Administration
SBAR Panel	Small Business Advocacy Review Panel (or, ‘The Panel’)
SBREFA	Small Business Regulatory Enforcement Fairness Act
SCR	Selective Catalytic Reduction
SCFM	“Standard” Cubic Feet Per Minute
SEA	Selective Enforcement Audit
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SO_x	Sulfur Oxides
SOLAS	(International Convention) for the Safety of life at Sea
SPD	Standard Power Density
STB	Surface Transportation Board
TBN	Total Base Number
THC	Total Hydrocarbon
TPD, tpd	Tons per day
ULSD	Ultra-low Sulfur Diesel
U.S.C.	United States Code
USCG	United States Coast Guard
USDA	United States Department of Agriculture
VOC	Volatile Organic Compound
VWT	Vanadium-Tungsten-Titanium Mixed Oxide
WHO	World Health Organization

1. GENERAL POSITION STATEMENTS... 1-1
1.1 Support for Rule.. 1-1

1. General Position Statements

What We Proposed:

The following comments relate in general to the Notice of Proposed Rulemaking (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 chapters of this Summary and Analysis of Comments.

For more information on the proposed rule, please see the Federal Register at 72 FR 15938, published on April 3, 2007: [*http://a257.g.akamaitech.net/7/257/2422/01jan20071800/edocket.access.gpo.gov/2007/pdf/07-1107.pdf*].

1.1 Support for Rule

What Commenters Said:

The comments we received stated that commenters generally supported the intent of the proposed rulemaking in minimizing exhaust emissions for locomotives and marine diesel engines. However, many of these commenters stated that, although they support the intent of proposed rule, they believe that the rule could be improved; each commenter offered their various suggestions on how they believed that the rule could be improved, and these comments are summarized in the following chapters of this Summary and Analysis document.

In general, these comments include recommendations on the stringency and timing of the standards, costs, technical feasibility, and timing of the final rule. Some commenters expressed the concern that the rule was not stringent enough (suggesting that EPA finalize more stringent standards, accelerate the proposed implementation dates, finalize the rule by the end of 2007, etc.), while others were concerned that the rule was too stringent (e.g., standards are infeasible or too costly, insufficient lead time, etc.). Other issues raised by individual commenters centered on safety concerns, fuel availability concerns, and the belief that EPA did not engage all potentially affected parties.

Letters:
American Lung Association (ALA) OAR-2003-0190-0509
American Lung Association of Metropolitan Chicago OAR-2003-0190-0518
American Lung Association of the Northwest OAR-2003-0190-0482
American Waterways Operators (AWO) OAR-2003-0190-0519
Association of American Railroads (AAR) OAR-2003-0190-0566.1
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485
Clean Air Task Force (CATF) OAR-2003-0190-0499

Clean Air Watch OAR-2003-0190-0500
Columbia River Gorge Commission OAR-2003-0190-0516
Cummins Inc. OAR-2003-0190-0501
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502
Engine Manufacturers Association (EMA) OAR-2003-0190-0545
Environmental Defense OAR-2003-0190-0487
Friends of the Earth OAR-2003-0190-0609
(City of) Houston Bureau of Air Quality Control (BAQC) OAR-2003-0190-0561.1
Johnson Matthey OAR-2003-0190-0488
Manufacturers of Emission Controls Association (MECA) OAR-2003-0190-0494
Markle Marine Safety Services OAR-2003-0190-0547.1
Marathon Petroleum Company LLC OAR-2003-0190-0595.1
MIRATECH OAR-2003-0190-0505
Missouri Department of Natural Resources, Air Pollution Control ProgramOAR-2003-0190-0658
MTU Detroit Diesel, Inc. OAR-2003-0190-0573.1
National Association of Clean Air Agencies (NACAA) OAR-2003-0190-0495
National Park Service-Pacific West Region (NPS) OAR-2003-0190-0480
Natural Resources Defense Council (NRDC)OAR-2003-0190-0489
New Jersey Department of Environmental Protection, Air Quality Management (NJDEP) OAR-2003-0190-0562.2
New York Department of Environmental Conservation, Office of Air Resources OAR-2003-0190-0583.1
North Kingston Community Association OAR-2003-0190-0496
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0512, 0551.1
Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, Northwest District Association Health and Environment Committee OAR-2003-0190-0593.1
Oregon Department of Environmental Quality, Air Quality Division (ODEQ) OAR-2003-0190-0506
Oregon Environmental Council (OEC) OAR-2003-0190-0652
Passenger Vessel Association (PVA) OAR-2003-0190-0507
People for Puget Sound OAR-2003-0190-0649
Port of Seattle OAR-2003-0190-0469.1
Private Citizens (*various*)
Puget Sound Clean Air Agency OAR-2003-0190-0484
Rail World, Inc. OAR-2003-0190-0474
Railpower Hybrid Technologies Corp. OAR-2003-0190-0492
San Joaquin Valley Air Pollution Control District OAR-2003-0190-0556.1
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0483
Southwest Clean Air Agency OAR-2003-0190-0468
Texas Commission on Environmental Quality (TCEQ) OAR-2003-0190-0612.1
Washington State Department of Transportation (WSDOT) OAR-2003-0190-0555.2
Washington State Ferry System (WSF) OAR-2003-0190-0555.2

Wisconsin Department of Natural Resources, Bureau of Air Management (WDNR)
OAR-2003-0190-0552
Wyoming Outdoor Council   OAR-2003-0190-0467

Our Response:

We appreciate all comments on the proposed rule; specific responses to the various concerns raised by individual commenters are in chapters 2 through 11 of this Summary and Analysis of Comments document.

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2. Air Quality and Health Impacts

What We Proposed:

The comments in this section correspond mainly to Section II of the preamble to the proposed rule, and are therefore targeted at the air quality and health impacts of the rule. A summary of the comments received, as well as our response to those comments, is located below.

2.1 Public Health Impacts of PM, Ozone and Air Toxics

What Commenters Said:

At one of the public hearings, the Natural Resources Defense Council (NRDC) noted that locomotive yards and marine ports are major hubs of economic activity and major sources of pollution. The commenter noted that a typical freight railyard or marine port hosts enormous diesel engines running on some of the highest-sulfur diesel fuel available, thousands of related truck trips per day, and other polluting equipment and activities—together these engines emit huge amounts of PM and NOx, as well as other toxic air contaminants that can cause or exacerbate an array of environmental impacts (e.g., increased asthma attacks and emergencies, chronic bronchitis, emphysema, heart disease, and premature death) that seriously affect millions of Americans.

The Oregon Environmental Council (OEC) commented that pollution from dirty diesel trains and boats contributes to a myriad of public health threats including asthma, heart attacks, heart disease and cancer.

Letters:

Natural Resources Defense Council (NRDC)	OAR-2003-0190-0489
Oregon Environmental Council (OEC)	OAR-2003-0190-0652

Our Response:

We agree with the commenters that emissions from locomotives and marine diesel engines generate significant emissions of fine particulate matter ($PM_{2.5}$) and oxides of nitrogen (NOx) that contribute to nonattainment of the National Ambient Air Quality Standards for $PM_{2.5}$ and ozone. NOx is a key precursor to ozone and secondary PM formation. We estimate that today these engines account for about 20 percent of national mobile source NO_x emissions and about 25 percent of mobile source diesel $PM_{2.5}$ emissions. Ozone and $PM_{2.5}$ are associated with serious public health problems including premature mortality, aggravation of respiratory and cardiovascular disease, aggravation of existing asthma, acute respiratory symptoms, chronic bronchitis, and decreased lung function. These engines also emit hazardous air pollutants or air toxics, which are also associated with serious adverse health effects. These engines emissions are of particular concern, as exposure to diesel exhaust has been judged likely to pose a lung cancer hazard for humans as well as a hazard from noncancer respiratory effects. Finally, emissions from locomotive and marine diesel engines cause harm to public welfare, including contributing to visibility impairment and other harmful environmental impacts across the U.S.

2.1.1 Health Effects Related to Diesel Exposure

What Commenters Said:

The Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, and Northwest District Association Health and Environment Committee (Commenters) commented that since 2002, EPA has classified diesel exhaust as a likely carcinogen. Diesel exhaust contains more than 40 different toxic chemicals, many of which are known or suspected carcinogens, such as benzene, 1,3-butadiene, and polycyclic aromatic hydrocarbons.

The American Lung Association (ALA) of the Northwest noted that the National Toxicology Program's Report on Carcinogens classified diesel exhaust particulates as "reasonably anticipated to be a human carcinogen." The commenter further noted that numerous studies link diesel exhaust to increased incidence of lung cancer.

Environmental Defense, NRDC, et al. commented that diesel exhaust contains more than 40 different toxic chemicals and has been classified as a probable/known human carcinogen—the commenter noted that dozens of toxic air contaminants are found in diesel exhaust, many of which are known or suspected to cause cancer. The commenter noted various diesel constituents and stated that some of these have been associated with increased risk of a variety of cancers (OAR-2003-0190-0592.1, Appendix B).

In Appendix C of their comments, Environmental Defense, NRDC, et al. noted various health studies and toxicological reviews that consider diesel to be, or likely to be, a human carcinogen (OAR-2003-0190-0592.1, p. 43- Appendix C). The commenter noted that the National Institute for Occupational Safety and Health, the International Agency for Research on Cancer, the Health Effects Institute, the World Health Organization, the U.S. Department of Health and Human Services National Toxicology Program, and the U.S. Environmental Protection Agency have all determined that diesel exhaust is a probable or likely human carcinogen, and that California EPA has classified it as a known human carcinogen. Appendix C of their comments lists some of the major documents pertaining to the carcinogenicity of diesel exhaust.

Environmental Defense, NRDC, et al. commented that diesel air pollution adds to cancer risk all around the country. For example, in Washington approximately 87% of the cancer risk due to air pollutants comes from mobile sources like cars, trucks, ships and trains. In New York

County 96% of the air cancer risk is due to mobile sources. The commenters stated that diesel emissions are the hazardous air pollutant with the highest contribution to cancer risk.

The Puget Sound Clean Air Agency commented that it believes diesel exhaust is a serious public health concern. The commenter prepared a toxic risk evaluation with the Washington Department of Ecology which shows that, of the toxics in our ambient air, diesel particulate matter accounts for 70 to 80% of the cancer risk. The commenter stated that this rule is an important addition to EPA's National Clean Diesel Campaign and that it believes the rule will bring needed improvements in public health to the central Puget Sound region as a result of reducing diesel exhaust exposure.

The Clean Air Task Force (CATF) commented that diesel engine exhaust from locomotives and marine engines causes substantial harm to public health and the environment. The commenter stated that diesel exhaust is a hazardous mix of toxic and carcinogenic pollutants, including fine particulates, nitrogen oxides, toxic organic gases, and heavy metals; and causes premature death, lung cancer, heart attacks, strokes, and many other heart and lung problems. The commenter stated that it believes that the reduction of diesel pollution is one of the most pressing public health problems in our country today.

Environmental Defense cited that EPA and the World Health Organization (WHO) have classified diesel exhaust as a probable or likely human carcinogen; and the California EPA has classified it as a known human carcinogen.

The National Association of Clean Air Agencies (NACAA) noted that many additional areas of the country are adversely affected by unacceptably high levels of toxic air pollution, much of which is caused or exacerbated by diesel engine emissions. Lastly, the commenter noted that diesel exhaust is a likely human carcinogen, leading to increased risk of lung cancer from emissions from these engines.

<u>Letters:</u>
American Lung Association of the Northwest OAR-2003-0190-0482 (hearing)
Clean Air Task Force OAR-2003-0190-0499
Environmental Defense, NRDC, et al. OAR-2003-0190-0592.1
Environmental Defense OAR-2003-0190-0487 (hearing)
National Association of Clean Air Agencies (NACAA) OAR-2003-0190-0495
Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, and Northwest District Association Health and Environment Committee (Commenters) OAR-2003-0190-0593.1
Puget Sound Clean Air Agency OAR-2003-0190-0484 (hearing)

Our Response:

We agree that exposure to diesel exhaust has been classified by EPA as being likely carcinogenic to humans, and our Assessment Document for Diesel Engine Exhaust (Diesel

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

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

2.1.2 Health Effects Related to PM Exposure

What Commenters Said:

At one of the public hearings, NRDC noted that locomotive yards and marine ports are major hubs of economic activity and major sources of pollution. The commenter noted that a typical freight railyard or marine port hosts enormous diesel engines running on some of the highest-sulfur diesel fuel available, thousands of related truck trips per day, and other polluting equipment and activities—together these engines emit huge amounts of PM and NOx, as well as other toxic air contaminants that can cause or exacerbate an array of environmental impacts (e.g., increased asthma attacks and emergencies, chronic bronchitis, emphysema, heart disease, and premature death) that seriously affect millions of Americans.

ALA of Metropolitan Chicago commented that it believes that study after study add to the conclusion that air pollutants like fine particles are much more dangerous, and cause health problems at far lower concentrations, than previously thought. The commenter stated that these new studies validate the overwhelming scientific consensus that particle pollution causes illness, hospitalization and death (estimated at 70,000 per year); and breathing particulate air pollution can trigger asthma attacks and cause wheezing, coughing, and respiratory irritation. The commenter also stated that children who breathe particle pollution face changes in lung function that can limit them for life.

Environmental Defense, NRDC, et al. stated that that fine PM is a constituent of diesel exhaust. The commenters noted that particulate pollution is a mixture of soot, smoke and tiny particles formed in the atmosphere from sulfur dioxide ($S0_2$), NOx, and ammonia (NH_3). The commenters further noted that sooty particles are most dangerous when very small (less than

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

around 2.5 microns in diameter), as they are easily inhaled and reach deep into the lungs where they can trigger an inflammatory response. The smallest particles (those less than around 0.1 microns) can enter the circulatory system and damage blood vessels. The commenters stated that breathing in air heavy with tiny particles can be dangerous, even over a short time, and that children are especially vulnerable because their lungs are still developing. The commenters stated that $PM_{2.5}$ is associated with a host of adverse health effects including decreased lung function, allergic responses, chronic obstructive pulmonary disease, lung cancer, and both acute and chronic cardiovascular effects. The commenters noted that current ambient concentrations of particulate matter are considered a health risk in many locations throughout the country; and pointed out that EPA has stated that locomotive and marine diesel engines emit substantial quantities of $PM_{2.5}$. PM toxicity may be attributed to the particle's physical presence in biological tissues, its chemical constituents, including chemicals adsorbed on the particle, or a combination of these factors. Despite the considerable regional variability in the constituents of particulate matter, the commenters stated that they believe epidemiological evidence that ambient exposures to PM are associated with numerous adverse health effects is remarkably clear and consistent, and the consistency of the data make it feasible to quantify the benefits for a suite of health indicators (e.g., premature mortality, bronchitis, hospital admissions for both respiratory and cardiovascular events, emergency room visits for asthma, nonfatal heart attacks, lower and upper respiratory illness, minor restricted-activity days, work loss days, asthma exacerbations, respiratory symptoms (asthmatic population), and infant mortality). The commenters stated that the accumulation of published studies (noted in the Draft RIA) serve to strengthen the case for an association between PM exposure and respiratory inflammation and infection leading to premature mortality in children under 5 years of age. The commenters pointed to the findings of the Science Advisory Board-Health Effects Subcommittee (SAB-HES), which references numerous corroborating studies linking PM exposure to numerous adverse health outcomes. Lastly, the commenters stated that the extended observational period of these studies, combined with more sophisticated exposure assessments continue to strengthen the evidence that particulate matter poses a significant health threat at current levels of exposure. The commenters noted that more than 100 scientists called on EPA to significantly strengthen the National Ambient Air Quality Standard (NAAQS) for fine particulates.

Particulate matter can aggravate respiratory conditions such as asthma and chronic bronchitis and has been associated with cardiac arrhythmias (heartbeat irregularities), heart attacks and premature deaths. People with heart or lung disease, the elderly and children are at highest risk from exposure to particulate pollution. When EPA revised the national health-based air quality standards for fine particles in 2006, EPA estimated that the revised standards would result in an estimated reduction in:

–1,200 to 13,000 premature deaths in people with heart or lung disease,
–2,600 cases of chronic bronchitis,
–5,000 nonfatal heart attacks,
–1,630 hospital admissions for cardiovascular or respiratory symptoms,
–1,200 emergency room visits for asthma,
–7,300 cases of acute bronchitis,
–97,000 cases of upper and lower respiratory symptoms,
–51,000 cases of aggravated asthma,

–350,000 days when people miss work or school, and
–2 million days when people must restrict their activities because of particle pollution-related symptoms.

ALA commented that trains and boats are a large source of particulate pollution. The commenter noted that particles of special concern to the protection of lung health are those known as fine particles, less than 2.5 microns in diameter ($PM_{2.5}$); and explained that fine particles are easily inhaled deeply into the lungs where they can be absorbed into the bloodstream or remain embedded for long periods of time. The commenter cited studies showing the dangers of particle pollution and stated that these studies validate the overwhelming scientific consensus that particle pollution causes illness, hospitalization and premature death. The commenter noted that breathing particulate air pollution can trigger asthma attacks and cause wheezing, coughing, and respiratory irritation, and specifically noted that children who breathe particle pollution face changes in lung function that can limit them for life.

ALA also commented that ozone and particulate matter air pollution are especially harmful to children and teens, anyone over age 65, people with lung diseases, and anyone with cardiovascular disease or diabetes. Lastly, the commenter stated that even healthy adults who work or exercise outdoors-including probably employees of the railroads and marine industry-are also demonstrably affected by these pollutants.

NESCAUM noted that ground-level ozone and particulate matter have been linked to a range of serious respiratory health problems and they increase the risk of premature death, and diesel exhaust has also been classified as a probable carcinogen.

NACAA commented that the substantial levels of emissions from locomotive and marine diesel engines contribute to unhealthful concentrations of fine particles and ozone; which can translate into startling health impacts, including premature deaths, as well as heart disease, aggravated asthma and other respiratory conditions.

ALA of the Northwest stated that it believes that trains and boats are a significant source of particulate pollution. The commenter also noted that a substantial body of research now exists establishing that particle pollution causes illness, hospitalization, and premature death.

At the public hearing, ALA of the Northwest commented that there are one million people in its region living with lung disease that are vulnerable to the harmful effects of air pollution. The commenter stated that it is concerned about pollution in the form of dirty soot from diesel engines, fine particulate matter, and NOx.

ALA of the Northwest also commented that children breathing particle pollution can limit their lung function for life; and particle pollution harms anyone over the age of 65, people with lung diseases such as asthma and chronic obstructive pulmonary disease (COPD), as well as those at risk for cardiovascular disease or diabetes. The commenter pointed out that even healthy adults who work or exercise outdoors are affected by these pollutants. In Washington State, the commenter noted, 10% of the entire population (over 500,000 people) has asthma, and reducing diesel emissions would improve the quality of life for these people. The commenter stated that it knows that ozone and particulate pollution have been linked to premature death and that diesel exhaust has been linked to cancer.

The South Coast Air Quality Management District (SCAQMD) commented that numerous local, national, and international studies confirm that ozone and particulate pollution have a direct impact on respiratory health, increasing asthma attacks, bronchitis, emphysema, COPD, lung cancer, and premature death. Studies in Southern California have found a significant risk of irreversible decline in lung function among children growing up in areas with relatively high particulate pollution. The California Air Resources Board (CARB) estimated that particulate pollution in the Basin causes as many as 5,400 premature deaths, 2,400 hospital admissions, 140,000 asthma and respiratory symptoms, 980,000 lost workdays, and 5 million restricted activity days for minors, every year.

The Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, and Northwest District Association Health and Environment Committee (Commenters) commented that these two pollutants (NOx and $PM_{2.5}$) contribute to serious health problems, including premature mortality, aggravation of respiratory and cardiovascular disease, aggravation of existing asthma, acute respiratory symptoms, and chronic bronchitis.

Letters:
American Lung Association OAR-2003-0190-0509 (hearing)
American Lung Association of Metropolitan Chicago OAR-2003-0190-0518 (hearing)
American Lung Association of the Northwest OAR-2003-0190-0482 (hearing)
Environmental Defense, NRDC, et al. OAR-2003-0190-0592.1
National Association of Clean Air Agencies (NACAA) OAR-2003-0190-0495 (hearing)
Natural Resources Defense Council (NRDC) OAR-2003-0190-0489 (hearing)
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0551.1
Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, Northwest District Association Health and Environment Committee OAR-2003-0190-0593.1
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0558.1

Our Response:

We agree with commenters that there are significant health concerns associated with PM emissions. Scientific studies show ambient PM is associated with a series of adverse health effects. These health effects are discussed in detail in the 2004 EPA Particulate Matter Air

Quality Criteria Document (PM AQCD), and the 2005 PM Staff Paper.[2,3] Further discussion of health effects associated with PM can also be found in the RIA for this rule.

Health effects associated with short-term exposures (hours to days) to ambient PM include premature mortality, increased hospital admissions, heart and lung diseases, increased cough, adverse lower-respiratory symptoms, decrements in lung function and changes in heart rate rhythm and other cardiac effects. Studies examining populations exposed to different levels of air pollution over a number of years, including the Harvard Six Cities Study and the American Cancer Society Study, show associations between long-term exposure to ambient $PM_{2.5}$ and both total and cardiovascular and respiratory mortality.[4] In addition, a reanalysis of the American Cancer Society Study shows an association between fine particle and sulfate concentrations and lung cancer mortality.[5]

The health effects of $PM_{2.5}$ have been further documented in local impact studies which have focused on health effects due to $PM_{2.5}$ exposures measured on or near roadways. These studies take into account all air pollution sources, including both spark-ignition (gasoline) and diesel powered vehicles, and indicate that exposure to $PM_{2.5}$ emissions near roadways, which are dominated by mobile sources, are associated with potentially serious health effects. For instance, a recent study found associations between concentrations of cardiac risk factors in the blood of healthy young police officers and $PM_{2.5}$ concentrations measured in vehicles.[6] Also, a number of studies have shown associations between residential or school outdoor concentrations of some fine particle constituents that are found in motor vehicle exhaust, and adverse respiratory outcomes, including asthma prevalence in children who live near major roadways.[7,8,9] Although the engines considered in this rule differ from those in these studies with respect to their applications and fuel qualities, these studies provide an indication of the types of health effects that might be expected to be associated with personal exposure to $PM_{2.5}$ emissions from large marine diesel and locomotive engines.

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

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

[4] Dockery, DW; Pope, CA III: Xu, X; et al. 1993. An association between air pollution and mortality in six U.S. cities. N Engl J Med 329:1753-1759.

[5] Pope, C. A., III; Burnett, R. T.; Thun, M. J.; Calle, E. E.; Krewski, D.; Ito, K.; Thurston, G. D. (2002) Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution. J. Am. Med. Assoc. 287:1132-1141.

[6] Riediker, M.; Cascio, W.E.; Griggs, T.R.; et al. (2004) Particulate matter exposure in cars is associated with cardiovascular effects in healthy young men. *Am J Respir Crit Care Med* 169: 934–940.

[7] Van Vliet, P.; Knape, M.; de Hartog, J.; Janssen, N.; Harssema, H.; Brunekreef, B. (1997). Motor vehicle exhaust and chronic respiratory symptoms in children living near freeways. Env. Research 74: 122-132.

[8] Brunekreef, B., Janssen, N.A.H.; de Hartog, J.; Harssema, H.; Knape, M.; van Vliet, P. (1997). Air pollution from truck traffic and lung function in children living near roadways. Epidemiology 8:298-303.

[9] Kim, J.J.; Smorodinsky, S.; Lipsett, M.; Singer, B.C.; Hodgson, A.T.; Ostro, B (2004). Traffic-related air pollution near busy roads: The East Bay children's respiratory health study. Am. J. Respir. Crit. Care Med. 170: 520-526.

EPA recently conducted an initial screening analysis study of 47 selected marine port areas and 30 rail yards[10,11] to begin to better understand the populations that are living near these rail yards and marine ports. The results indicate that at least 13 million people live near these facilities, including a high percentage of low-income African-Americans and Hispanics, whom are being exposed to elevated levels of diesel exhaust, and will benefit from the controls being finalized in this action. In addition, recent new studies[12] from the State of California provide evidence that $PM_{2.5}$ emissions within marine ports and rail yards contribute significantly to elevated ambient concentrations near these sources. A substantial number of people experience exposure to locomotive and marine diesel engine emissions, raising potential health concerns. The controls finalized in this action will help reduce exposure to $PM_{2.5}$, specifically exposure to marine port and rail yard related diesel $PM_{2.5}$ sources. Additional information on marine port and rail yard emissions and ambient exposures can be found in Chapter 2 of the RIA.

2.1.3 Health Effects Related to Ozone Exposure

What Commenters Said:

The Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, and Northwest District Association Health and Environment Committee (Commenters) commented that These two pollutants (NOx and $PM_{2.5}$) contribute to serious health problems, including premature mortality, aggravation of respiratory and cardiovascular disease, aggravation of existing asthma, acute respiratory symptoms, and chronic bronchitis.

ALA commented that NOx from diesel engines contribute to ozone, (or ‘smog’), and ozone is a powerful respiratory irritant which can cause shortness of breath, chest pain, wheezing and coughing. The commenter also noted that ozone can trigger an asthma attack. The commenter stated that people with existing lung disease like COPD already suffer from reduced lung function, and these people cannot tolerate an additional reduction in lung function due to ozone exposure, so they are especially at risk. ALA also commented that there is a growing body of strong evidence that warns that breathing ozone at levels currently seen in the U.S. can lead to premature death; the researchers have found that the risk of premature death increased with higher levels of ozone, even on days when ozone levels were below the current national

[10] ICF International. September 28, 2007. Estimation of diesel particulate matter concentration isopleths for marine harbor areas and rail yards. Memorandum to EPA under Work Assignment Number 0-3, Contract Number EP-C-06-094. This memo is available in Docket EPA-HQ-OAR-2003-0190.

[11] ICF International. September 28, 2007. Estimation of diesel particulate matter population exposure near selected harbor areas and rail yards. Memorandum to EPA under Work Assignment Number 0-3, Contract Number EP-C-06-094. This memo is available in Docket EPA-HQ-OAR-2003-0190.

[12] State of California Air Resources Board. Roseville Rail Yard Study. Stationary Source Division, October 14, 2004. This document is available in Docket EPA-HQ-OAR-2003-0190. This document is available electronically at: http://www.arb.ca.gov/diesel/documents/rrstudy.htm. Diesel Particulate Matter Exposure Assessment Study for the Ports of Los Angeles and Long Beach, April 2006. This document is available in Docket EPA-HQ-OAR-2003-0190. This document is available electronically at: ftp://ftp.arb.ca.gov/carbis/msprog/offroad/marinevess/documents/portstudy0406.pdf

standard.

ALA also commented that ozone and particulate matter air pollution are especially harmful to children and teens, anyone over age 65, people with lung diseases, and anyone with cardiovascular disease or diabetes. Lastly, the commenter stated that even healthy adults who work or exercise outdoors-including probably employees of the railroads and marine industry-are also demonstrably affected by these pollutants.

Environmental Defense, NRDC, et al. commented that the 2007 Air Quality Criteria Document for ozone confirms that the adverse effects of ozone (O_3) are noncontroversial and compelling. The commenters stated that adverse effects that have been observed in controlled exposure and field/panel studies include respiratory effects (e.g., reduced pulmonary function), among both healthy and asthmatic children and adults exposed acutely for 1 - 8 hours to 0.08 ppm while physically active. The commenters also noted that more recent studies indicate that sensitive individuals are affected at concentrations below 0.08 ppm. The commenters pointed to laboratory animal studies, which they stated have boosted the biological plausibility of other adverse outcomes identified in human epidemiological studies, including cardiovascular effects and mortality, and provide a mechanistic understanding for accepted adverse outcomes related to pulmonary function. The commenters cited a study (Bell and colleagues) which examined the concentration-response curve for the ozone-mortality relationship; the study, using data from 98 urban communities, found “strong and consistent evidence” that ozone exposure is associated with premature mortality, and indicated there was no evidence of a threshold above ‘background’ concentrations. The commenters stated that they believe this new data demonstrates the need to reduce ozone levels below current levels. The commenters stated that, according to EPA’s Clean Air Scientific Advisory Committee (CASAC) and Children’s Health Protection Advisory Committee, the ozone standard should in fact be reduced to a level that is below 70 ppb (they further noted that EPA’s “more than 100 air researchers and physicians have indicated their support for strengthening the ozone standard”).

The commenters also noted that diesel air pollution contributes to harmful smog levels. Nationwide monitoring similarly indicates that 157 million people living in 461 counties are exposed to levels of ground-level ozone or ‘smog’ that exceed the national health-based standard. Furthermore, the ozone NAAQS are in the process of being updated. If they are updated to reflect the state of the science, it will expand the number of areas with ozone concentrations at levels that do not protect public health and the environment (see page 5 of Docket Number 0592.1 for the map). High ozone levels cause acute respiratory problems, aggravated asthma, decreased lung function, inflammation of lung tissue, an increase in hospital admissions and emergency room visits for respiratory causes, and crop damage. Children with asthma are most at risk. Ozone is also associated with premature death.

NESCAUM noted that ground-level ozone and particulate matter have been linked to a range of serious respiratory health problems and they increase the risk of premature death, and diesel exhaust has also been classified as a probable carcinogen.

NACAA commented that the substantial levels of emissions from locomotive and marine diesel engines contribute to unhealthful concentrations of fine particles and ozone; which can translate into startling health impacts, including premature deaths, as well as heart disease, aggravated asthma and other respiratory conditions.

ALA of Metropolitan Chicago stated that although ozone grades did improve slightly in several counties in the Chicago area, it has to be seen in context of the current EPA process for re-evaluating the ozone NAAQS itself. The commenter noted that the CASAC has stated that "There is no scientific justification for retaining the current primary 8-hr NAAQS...." And further, CASAC head Rogene Henderson wrote to EPA Administrator Johnson, noting that "Ozone Panel members were unanimous in recommending that the level of the current primary ozone standard should be lowered from 0.08 ppm to no greater than 0.070 ppm." The commenter also noted that EPA's Children's Health Protection Advisory Committee has told the Agency that it "strongly recommends setting the proposed standard at 0.060 ppm, the lowest value of the range offered by the [EPA] staff paper, and a level which is supported by the scientific literature."

ALA of Metropolitan Chicago believes that study after study add to the conclusion that air pollutants like ozone and fine particles are much more dangerous, and cause health problems at far lower concentrations, than previously thought.

SCAQMD commented that numerous local, national, and international studies confirm that ozone and particulate pollution have a direct impact on respiratory health, increasing asthma attacks, bronchitis, emphysema, COPD, lung cancer, and premature death.

ALA of the Northwest commented that NOx emissions from diesels contribute to ozone, which can trigger an asthma attack; and that ozone causes people with existing lung disease like COPD, chronic bronchitis, and emphysema to suffer from reduced lung function.

At the public hearing, the American Lung Association of the Northwest commented that there are one million people in its region living with lung disease that are vulnerable to the harmful effects of air pollution. The commenter stated that it is concerned about pollution in the form of dirty soot from diesel engines, fine particulate matter, and NOx.

The American Lung Association of the Northwest also commented that children breathing particle pollution can limit their lung function for life; and particle pollution harms anyone over the age of 65, people with lung diseases such as asthma and COPD, as well as those at risk for cardiovascular disease or diabetes. The commenter pointed out that even healthy adults who work or exercise outdoors are affected by these pollutants. In Washington State, the commenter noted, 10% of the entire population (over 500,000 people) has asthma, and reducing diesel emissions would improve the quality of life for these people. The commenter stated that it knows that ozone and particulate pollution have been linked to premature death and that diesel exhaust has been linked to cancer.

<u>Letters:</u>
American Lung Association OAR-2003-0190-0509 (hearing)

American Lung Association of Metropolitan Chicago OAR-2003-0190-0518 (hearing)
American Lung Association of the Northwest OAR-2003-0190-0482 (hearing)
Environmental Defense, NRDC, et al. OAR-2003-0190-0592.1
National Association of Clean Air Agencies (NACAA) OAR-2003-0190-0495 (hearing)
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0551.1
Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, Northwest District Association Health and Environment Committee OAR-2003-0190-0593.1
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0558.1

Our Response:

As discussed in Section II of the Preamble and Chapter 2.2.2 of the RIA, exposure to ambient ozone contributes to a wide range of adverse health effects.[13] These health effects are well documented and are critically assessed in the EPA ozone air quality criteria document (ozone AQCD) and EPA staff paper.

We agree that ozone-related health effects include premature mortality, lung function decrements, respiratory symptoms, aggravation of asthma, increased hospital and emergency room visits, increased asthma medication usage, inflammation of the lungs, a variety of other respiratory effects, and possibly cardiac-related effects. People who are more susceptible to effects associated with exposure to ozone include children, asthmatics and the elderly. Those with greater exposures to ozone, for instance due to time spent outdoors (e.g., children and outdoor workers, including workers of locomotive and marine activities), are also of concern. Based on a large number of scientific studies, EPA has identified several key health effects associated with exposure to levels of ozone found today in many areas of the country.

The current ozone NAAQS has an 8-hour averaging time.[14] The 8-hour ozone NAAQS is met at an ambient air quality monitoring site when the average of the annual fourth-highest daily maximum 8-hour average ozone concentration over three years is less than or equal to 0.08 ppm. EPA's review of the ozone NAAQS is currently underway, the proposal was released in June 2007 (72 FR 37818, July 11, 2007) and the final rule is scheduled for March 2008. This review process is considering the comments of the Clean Air Scientific Advisory Committee and Children's Health Protection Advisory Committee to strengthen the ozone standard. If the ozone NAAQS is revised then new nonattainment areas could be designated. While EPA is not relying on it for purposes of justifying this rule, the emission reductions from this rulemaking will also be helpful to states if EPA revises the ozone NAAQS to be more stringent. The locomotive and

[13] Human exposure to ozone varies over time due to changes in ambient ozone concentration and because people move between locations which have notable different ozone concentrations. Also, the amount of ozone delivered to the lung is not only influenced by the ambient concentration but also by the individuals breathing route and rate.
[14] EPA's review of the ozone NAAQS is underway, the proposal was published in June 2007 and the final rule is scheduled for March 2008.

marine engine emission reductions will assist 8-hour ozone nonattainment areas in reaching the standard by each area's respective attainment date and/or assist in maintaining the 8-hour ozone standard in the future.

2.2 Environmental Impacts of PM, Ozone and Air Toxics

What Commenters Said:

NACAA commented that emissions from locomotive and marine engines lead to a host of environmental harms, such as visibility impairment, crop damage and acid rain.

The National Park Service (NPS) noted that environmental effects are potentially significant due to the proximity of emission sources to large number of Class 1 areas, sensitive ecosystems and cultural resources, and the synergistic effects of pollutants and multiple stressors.

Letters:
National Association of Clean Air Agencies (NACAA) OAR-2003-0190-0495 (hearing)
National Park Service-Pacific West Region OAR-2003-0190-0480 (hearing)

Our Response:

We agree that emissions from locomotive and marine engines contribute to environmental effects. In the preamble EPA states "There are a number of public welfare effects associated with the presence of ozone, NOx and $PM_{2.5}$ in the ambient air. The impact of NOx and $PM_{2.5}$ on ecosystems, visibility, and materials and the impact of ozone on plants, including trees, agronomic crops and urban ornamentals are discussed". The emissions reductions being finalized in this rule will help to reduce environmental effects associated with the emissions from locomotive and marine engines.

2.2.1 Visibility

What Commenters Said:

The Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, and Northwest District Association Health and Environment Committee noted that NOx and PM from diesel engines contribute to visibility impairment in the Columbia Gorge National Scenic Area and federal class I areas in the Northwest. The commenters stated that they agree that visibility has a direct impact on people's enjoyment of daily activities and their well-being in general (72 FR 15960), and visibility also contributes to the economic resources of a community. The commenters cited an estimate that each extreme bad visibility day in Vancouver, British Columbia represents $7.45 million in lost future revenue, and stated that it would be expected that poor visibility days in the Columbia Gorge National Scenic Area would result in an analogous loss of revenue. The commenters noted that NOx is emitted from line haul locomotives in the Columbia River Gorge National Scenic Area in an amount that is over two thirds as much as the NOx emitted from the PGE Boardman coal-fired power plant (which is recognized as the area's largest single contributor to regional haze and is currently undergoing Best Available Retrofit Technology (BART) analysis under EPA's Regional Haze Rule). The commenters stated that recent modeling suggests that improvement in visibility would occur in all U.S. federal class I areas through implementation of this proposed diesel engine rule (72 FR 15961).

The Columbia River Gorge Commission noted that emissions from railroads and marine engines contribute to impairment of visibility and other air quality impacts in the Columbia River Gorge National Scenic Area. The commenter noted that 60 freight trains and many boats and barges traverse the Columbia Gorge daily and that protecting and improving the visibility of this nationally protected region is a high priority.

The Oregon Department of Environmental Quality (ODEQ) noted that visibility is a prime air quality goal for the Scenic Area of the Columbia River Gorge.

Environmental Defense commented that diesel air pollution impairs visibility; the same fine particles that cause adverse health effects cause the haze that pollutes scenic vistas in national parks and wilderness areas, and creates 'brown clouds' in our urban centers.

The Southwest Clean Air Agency commented that it believes that an important need for this rule is its ability to improve air quality in the Columbia River Gorge National Scenic Area (CRGNSA). The commenter stated that the rule will benefit the public health of citizens in the adjacent Portland, Oregon and Vancouver, Washington metropolitan area. The commenter noted that the CRGNSA is a conduit for significant amounts of inter- and intrastate commerce and that Congress directly appropriated $1.1 million for air quality studies in this National Scenic Area. The commenter believes that the rule will assist Washington and Oregon in achieving compliance with EPA's Regional Haze rule and reducing impacts on the Class 1 areas that are adjacent to the CRGNSA.

Letters:
Columbia River Gorge Commission OAR-2003-0190-0516
Environmental Defense OAR-2003-0190-0487 (hearing)
Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, Northwest District Association Health and Environment Committee OAR-2003-0190-0593.1
Oregon Department of Environmental Quality, Air Quality Division (ODEQ) OAR-2003-0190-0506
Southwest Clean Air Agency OAR-2003-0190-0468

Our Response:

EPA agrees that locomotives and marine engines contribute to visibility concerns in $PM_{2.5}$ nonattainment areas and mandatory class I federal areas through both their primary $PM_{2.5}$ emissions and their NOx emissions, which contribute to the formation of secondary $PM_{2.5}$. The emissions reductions being finalized in this rule will help to improve visibility in mandatory class I federal areas and across the country.

2.2.2 Deposition

What Commenters Said:

Environmental Defense stated that diesel air pollution threatens revered ecosystems, and the constituents of diesel exhaust contribute to the acid rain that continues to harm sensitive ecosystems across Washington (the commenter cited a recent report by the Puget Sound Maritime Air Forum which demonstrated that maritime activity produces about 40% of all sulfur dioxide (SO_2) in the region).

The Oregon Department of Environmental Quality (ODEQ) noted that reducing damage to ecosystems and Native American rock images from acid rain is very important. The commenter noted that recent studies by the U.S. Forest Service have documented damage to ancient rock images resulting from NOx and other emissions from sources in and around the Columbia River Gorge. The commenter stated that it believes that the loss of these cultural resources is a serious blow to the native peoples that still utilize the Columbia River and its tributaries for subsistence fishing and gathering.

The Northwest Environmental Defense Center, et al. noted that recent Forest Service studies have shown that NOx and other emissions from sources in and around the Columbia River Gorge contribute to acid rain formation, resulting in damage to crops, ecosystems, and cultural artifacts, including ancient Native American rock images. Further, the commenter notes that acid rain and acidification have been shown to impact tree and crop growth, and can impact marketability of the product.

The Columbia River Gorge Commission noted that the Columbia Gorge contains very significant cultural and natural resources that are vulnerable to impacts from air pollution.

The Southwest Clean Air Agency commented that acid deposition within the Columbia River Gorge National Scenic Area has been studied by the U.S. Department of Agriculture (USDA) Forest Service and their concerns about ecosystem damage have been clearly made known to the Washington and Oregon Clean Air Agencies through USDA Forest Service's Fog Water Impacts Study.

At the Seattle public hearing, NPS noted the Preamble cites only to extreme aquatic eutrophication effects with regards to nitrogen deposition. The commenter believes that changes in aquatic communities and terrestrial effects are also important and that alpine lakes and vegetation are sensitive to nitrogen inputs.

Environmental Defense, NRDC, et al. commented that diesel air pollution threatens ecosystems across the country. The constituents of diesel exhaust contribute to the acid rain that continues to harm sensitive ecosystems in the Adirondack Mountains, the southern Appalachians and high elevation ecosystems in the western United States.

Letters:
Columbia River Gorge Commission OAR-2003-0190-0516
Environmental Defense OAR-2003-0190-0487 (hearing)
Environmental Defense, NRDC, et al. OAR-2003-0190-0592.1
National Park Service-Pacific West Region OAR-2003-0190-0480 (hearing)
Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, Northwest District Association Health and Environment Committee OAR-2003-0190-0593.1
Oregon Department of Environmental Quality, Air Quality Division (ODEQ) OAR-2003-0190-0506
Southwest Clean Air Agency OAR-2003-0190-0468

Our Response:

EPA agrees that emissions from locomotive and marine diesel engines contribute to deposition effects and that the emissions reductions being finalized in this rule will help reduce the adverse effects of deposition. We disagree that extreme aquatic eutrophication effects are the only effects of nitrogen deposition cited in the preamble of the rule. The preamble for the proposed, and final rule, describes that adverse impacts on soil chemistry and plant life such as species shifts, loss of biodiversity and forest decline and damage to forest productivity have been observed for areas heavily impacted by atmospheric deposition of nutrients, metals and acid species. There is also more detailed information on acid deposition included in the RIA for this final rule.

EPA appreciates the comments about the USDA Forest Service report. The results of the Forest Service's Fog Water Impacts Study are referenced in Section 2.1.5.2.1 of the RIA for this final rule as follows: "A study conducted in the Columbia River Gorge National Scenic Area (CRGNSA), located along a portion of the Oregon/Washington border, indicates that lichen communities in the CRGNSA have shifted to a higher proportion of nitrophilous species and the nitrogen content of lichen tissue is elevated. Lichens are sensitive indicators of nitrogen deposition effects to terrestrial ecosystems and the lichen studies in the Columbia River Gorge clearly show that ecological effects from air pollution are occurring".

Section 2.2.4 of this document specifically addresses damage to materials, including culturally important articles like ancient Native American rock images, from deposition.

2.2.3 Environmental Effects Caused by Ozone

What Commenters Said:

Environmental Defense, NRDC, et al. commented that tropospheric O_3 at the surface can exert adverse effects on nonhuman animal species, and vegetation.

The Northwest Environmental Defense Center, et al. noted that NOx is one of the ingredients in the formation of tropospheric ozone (called “the air pollutant most damaging to agricultural crops”).

The National Park Service noted that there are several areas of synergy, for instance nitrogen deposition and ozone together cause ‘major physiological disruption’ (CA) and increase bark beetle activity and tree mortality in drought conditions (CA). The NPS also noted that ozone contributes to global warming and exacerbates the effects of drought on forest growth and stream health (Appalachia).

Letters:
Environmental Defense, NRDC, et al. OAR-2003-0190-0592.1
National Park Service-Pacific West Region OAR-2003-0190-0480 (hearing)
Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, Northwest District Association Health and Environment Committee OAR-2003-0190-0593.1

Our Response:

EPA agrees that ozone contributes to many environmental effects, with impacts to plants and ecosystems being of most concern. Ozone can produce both acute and chronic injury in sensitive species depending on the concentration level and the duration of the exposure. Ozone effects also tend to accumulate over the growing season of the plant, so that even lower concentrations experienced for a longer duration have the potential to create chronic stress on vegetation.

We understand that air pollutants can also work synergistically and that the impacts of ozone or nitrogen deposition separately are much less than the impacts that would be felt by an ecosystem being exposed to both ozone and nitrogen deposition. In this rule we address synergistic effects by indicating that there are ecosystems and species which could be more sensitive to the impacts of ozone, for instance those impacted by nitrogen deposition, and vice versa.

The emissions reductions being finalized in this rule will help reduce ozone and therefore the adverse environmental effects of ozone, including global warming.

2.2.4 Materials Damage and Soiling

What Commenters Said:

The Northwest Environmental Defense Center, et al. noted that the Columbia River Treaty Tribes have expressed their concern about the air quality impacts on their subsistence fishing and other cultural resources.

The Southwest Clean Air Agency noted four Tribal Nations in the area that have Treaty Rights within the Columbia River Gorge National Scenic Area and have expressed firmly their concern about air quality impacts on their cultural resources and fishing rights within the Gorge. The commenter stated that under EPA's Nation-to-Nation consultation responsibilities with the Tribal Nations, EPA has the ability within this rulemaking to be responsive to the concerns of these four Tribal Nations.

ODEQ noted that reducing damage to ecosystems and Native American rock images from acid rain is very important. The commenter noted that recent studies by the U.S. Forest Service have documented damage to ancient rock images resulting from nitrogen oxides and other emissions from sources in and around the Columbia River Gorge. The commenter stated that it believes that the loss of these cultural resources is a serious blow to the native peoples that still utilize the Columbia River and its tributaries for subsistence fishing and gathering.

Letters:
Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, Northwest District Association Health and Environment Committee OAR-2003-0190-0593.1
Oregon Department of Environmental Quality, Air Quality Division (ODEQ) OAR-2003-0190-0506
Southwest Clean Air Agency OAR-2003-0190-0468

Our Response:

The deposition of airborne particles can reduce the aesthetic appeal of culturally important articles through soiling, and can contribute directly (or in conjunction with other pollutants) to structural damage by means of corrosion or erosion. In addition, excess nutrient inputs into aquatic ecosystems (i.e. streams, rivers, lakes, estuaries or oceans) either from direct atmospheric deposition, surface runoff, or leaching from nitrogen saturated soils into ground or surface waters can contribute to conditions of severe water oxygen depletion; eutrophication and algae blooms; altered fish distributions, catches, and physiological states; loss of biodiversity; habitat degradation; and increases in the incidence of disease. Severe and persistent eutrophication often directly impacts human activities. For example, losses in the nation's fishery resources may be directly caused by fish kills associated with low dissolved oxygen and toxic blooms. We believe that reducing emissions from locomotive and marine diesel engines is important for reducing air quality impacts on cultural and fishery resources.

2.2.5 Other Environmental Effects

What Commenters Said:

NPS commented that particulate pollution decreases snowfall in some areas of the west (Colorado and California) and contributes to drought.

Letters:
National Park Service-Pacific West Region OAR-2003-0190-0480 (hearing)

Our Response:

EPA believes that the emission reductions being finalized in this rule will reduce particulate pollution and its associated environmental impacts, including potential precipitation suppression.

2.3 Reducing Emissions of PM, Ozone, and Air Toxics from Locomotive and Marine Diesel Engines

What Commenters Said:

The Puget Sound Clean Air Agency commented that rail and marine activities in the central Puget Sound region generate significant fine particle pollution; and further cited the Puget Sound Maritime Emission Inventory, which stated that "harbor craft" (vessels that would be affected by the EPA proposal) are responsible for 14% of the regional diesel PM and 2% of the region's total $PM_{2.5}$ emissions. The commenter stated that these percentages are based on total regional contributions and the contributions of inland marine and locomotive engines are much greater in neighborhoods near ports and rail yards where these emissions are concentrated. The commenter also noted that the rapid increase in Asian trade could double the current number of containers at the Port of Seattle, and increase by 4 to 5 times the current number of containers at the Port of Tacoma over the next ten to twenty years; resulting in very large increases in both total mass emissions and the percentage contribution of these sources to our regional NOx, SOx, PM and diesel particulate emissions.

At the public hearing, NRDC noted that locomotive and marine engines emit huge amounts of PM and NOx, as well as other toxic air contaminants, that can cause or exacerbate an array of environmental impacts that seriously affect millions of Americans. The commenter stated that locomotive and marine diesel engines are the last of the dirty diesel engines, and noted that existing EPA programs will reduce sulfur levels in diesel fuel used at rail yards and marine ports, and will dramatically reduce emissions from any new trucks and nonroad equipment servicing these facilities over the next few years. NRDC commented that cars, light trucks, and sport-utility vehicles are getting cleaner and soon, new diesel cars will emit at the same level as the typical new gasoline car. The commenter contrasted these with locomotive and marine diesel engines, which it believes are en route to an alarmingly large share of the nation's vehicle-related PM and NOx emissions. The commenter cited figures which show that, from current trends, train and ship engines will emit more than 765,000 tons of NOx and 28,000 tons of PM every year by 2030. The commenter noted the strong regulatory programs promulgated over the past decade (for trucks, buses, nonroad diesel engines, and cars) which will render these engines at least 90 percent cleaner than previous engines. The commenter stated that it is time to close the last dirty diesel loopholes and clean up the trains, ships, and ferries. The commenter also noted that it believes that locomotive and marine diesel engines will more than double their share of vehicle-related NOx emissions and increase their share of vehicle-related PM emissions more than fourfold by 2030 unless EPA acts now.

Environmental Defense, NRDC, et al. commented that the locomotive and marine engines covered by the proposed rule currently account for about 17% of mobile source diesel $PM_{2.5}$ emissions in Seattle, and left unchecked this percentage would increase to 43% in 2020 and 60% in 2030. The commenters stated that they believe this rule can help address the important air quality challenges the nation and Seattle face. The commenters pointed out that by 2030, "these engines would become a large portion of the total mobile source emissions inventory constituting 35% of mobile source NOx emissions and 65% of diesel PM emissions."

Environmental Defense noted that the U.S. Department of Transportation (DOT) estimated that rail carried 1.95 million tons of freight in 1998 and that by 2030 the industry will transport nearly 3 million tons, an increase of about 50%, and that railroad transport has more than doubled in the last 35 years.

Environmental Defense noted that NRDC's March 2004 report, "Harboring Pollution: the Dirty Truth about U.S. Ports" stated that more than 95 percent of the PM and NOx pollution at a typical port comes from the ships, cargo handling equipment, and heavy trucks that service the cargo. The commenter further stated that air pollution from ports rivals or exceeds that from cars, power plants, and refineries in many urban areas. Additionally, the combination of expected future growth at ports and cleaner highway and nonroad diesel engines will make the relative contribution from locomotives and marine diesel engines grow significantly over time. The commenter cited 2001 EPA data which stated that trains and ships (excluding ocean-going vessels) contributed 16 percent of vehicle-related NOx and 18 percent of vehicle-related $PM_{2.5}$, and this contribution would rise to 34% and 63%, respectively, by 2030 without any further pollution controls.

At the public hearing, Environmental Defense commented that locomotive engines release voluminous amounts of NOx emissions, which contribute to lethal particulate pollution. The commenter noted that in Seattle alone, locomotives emit nearly 3500 tons of NOx air pollution each year, comparable to the pollution from about 3.7 million new cars. The commenter noted that numerous diesel engine manufacturers (those who make heavy duty trucks, buses, construction equipment, agricultural equipment, and mining equipment) are addressing the harmful NOx pollution from their engines, and now locomotive engine manufacturers must do the same.

The Port of Seattle commented that it believes EPA should not consider relaxing the proposed locomotive and marine diesel engine standards which are estimated to achieve PM emissions reductions of 90 percent and NOx reductions of 80 percent compared to engines meeting the current Tier 2 standards. The commenter stated that these emissions reductions, along with the anticipated reductions of non-methane hydrocarbons (NMHC), carbon, and air toxics, will be needed in the Puget Sound region and other areas to assure protection of public health and the environment in the future.

NACAA commented that it believes that diesel-fueled locomotives and marine engines are among the largest and most dangerous under-regulated sources of pollution in the U.S. The commenter also noted that, as stated in the proposal, emissions from these engines currently represent about 20 percent of all mobile source NOx and 25 percent of all mobile source diesel fine particulate matter. The commenter further stated that, because these engine categories are subject only to minimal controls, unless they are subject to more stringent regulation, their relative contribution to emission inventories is anticipated to increase by 2030 to more than one-third of mobile source NOx emissions and two-thirds of diesel PM emissions.

CARB noted that emissions from locomotive and marine engines are major contributors to California's ozone and fine particle smog problems. The commenter stated that California locomotive and marine engines contribute 30 percent of smog-forming NOx and 35 percent of toxic diesel PM from mobile sources that move goods around and through California. The commenter further noted that the current statewide emissions inventory estimates that commercial harbor craft contribute about 4 tons per day (tpd) of PM and 90 tpd of NOx, and ocean-going vessel auxiliary engines contribute another 4 tpd of PM and 44 tpd of NOx. Of the combined 8 tpd of PM and 134 tpd NOx, approximately 40 percent of these emissions come from engines that are less than 600 kilowatts (kW).

CARB also commented that the impact of emissions from Category 1 and 2 engines is greater than the statewide figures indicate because the emissions are concentrated in California's coastal non-attainment districts, particularly in port areas. The commenter also stated that the Los Angeles region (South Coast) is in non-attainment for both $PM_{2.5}$ and ozone, and attainment requires extensive emission reductions from all sources. The commenter noted that air pollution from international trade and domestic goods movement in California is a major public health concern at both the regional and community levels—goods movement is now the dominant contributor to transportation emissions in the State. The commenter's "Emission Reduction Plan for Ports and Goods Movement in California" identifies the many actions necessary to reduce these emissions, and addresses all significant emissions sources involved in international and domestic goods movement, including trucks, locomotives, marine vessels, harbor craft, and cargo handing equipment. The commenter noted that rules for sources under its direct authority have been adopted and more are under development. Also, the commenter noted that a significant amount of existing incentive funds have been applied to goods movement emission sources and it has prioritized continued funding on this source of statewide significance. The commenter noted that for locomotives, the plan proposes to control NOx and PM by 90 percent; and it relies heavily on new EPA Tier 4 locomotive emission standards combined with accelerated fleet turnover of locomotives once the new standards are established. (The commenter noted that accelerating the introduction of Tier 4 locomotives into California service is a similar approach to the 1998 Memorandum of Understanding (MOU) it has with the Class 1 railroads for locomotives in the South Coast Air Basin, which requires a Tier 2 NOx fleet average in the South Coast Basin by 2010). For marine engines the Plan relies upon reductions of 25 percent in reactive organic gas (ROG), NOx, and PM by 2010 and 40 percent by 2020. Lastly, the commenter stated that Tier 4 standards for these engines are critical to meeting its goals.

The North Carolina Division of Air Quality (NCDAQ) noted that commercial marine vessels with diesel engines operating in North Carolina were estimated to emit 3,526 tons of NOx and 135 tons of $PM_{2.5}$ in 2005. The commenter predicted (using Table II-5 from the NPRM) that $PM_{2.5}$ can be expected to be reduced 13.7%, 30%, 56%, and 72% in years 2015, 2020, 2030, and 2040, respectively, compared to what is anticipated without the regulations. The commenter similarly predicted (from Table II-7) estimated NOx reductions of 5.1% in 2015, 18.5% in 2020, 48% in 2030, and 66% in 2040.

The Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, and Northwest District Association Health and Environment Committee commented that they believe that without the proposed reductions, locomotive and marine diesel engines will likely contribute more than 65 percent of national mobile source diesel $PM_{2.5}$ emissions and 35 percent of national mobile source NOx emissions.

TCEQ noted that locomotives and marine diesel engines are important contributors to Texas' air pollution composition. The commenter stated that the locomotive sources affected by the proposed rule are estimated to have generated approximately 5.5 tpd of PM and 140.8 tpd of NOx emissions within Texas. Further, the commenter noted, marine sources are estimated to generate approximately 2.68 tpd of PM emissions and 68.9 tpd of NOx emissions.

People for Puget Sound commented that the recent Puget Sound Maritime Emission Inventory shows that harbor crafts are responsible for 14% of the regional diesel PM and 2% of the region's total fine particulate emissions.

The American Lung Association (ALA) of Metropolitan Chicago stated that, according to ALA's annual "State of the Air Report", air quality (specifically due to particle pollution) declined in the Chicago area; and specifically noted that Cook County, which contains approximately 5.5 million people, continued to receive a grade of "F."

The Southwest Clean Air Agency posed the following questions to EPA regarding NOx and PM emissions:

(1) How would EPA respond if it knew that locomotives were annually releasing 8,363 tons of NOx within the Columbia River Gorge National Scenic Area?
(2) How would EPA respond if it knew that towboats were annually releasing another 768 tons of NOx emissions within the Columbia River Gorge National Scenic Area?
(3) How does EPA believe its Nation-to-Nation Tribal consultation responsibilities should be handled for air quality impacts caused by locomotives and marine diesel engines traveling through the Columbia River Gorge National Scenic Area?

The commenter also requested that EPA consider that the Columbia River Gorge National Scenic Area has been designated by Congress and set aside in perpetuity for its beauty and the enjoyment of future generations and it has locomotive and marine diesel engine annual emissions totaling approximately 9,131 tons of NOx and 296 tons of $PM_{2.5}$. The commenter stated that it believes that clearly some additional action by EPA is needed.

NESCAUM commented that it believes that the need to reduce locomotive and marine diesel engine emissions is indisputable. The commenter noted that these engines are significant contributors to elevated levels of ozone, $PM_{2.5}$, and the primary emission sources of several toxic air pollutants of concern in the NESCAUM region. The commenter cited 2002 emissions inventories which stated that these source categories are responsible for around 10 percent of mobile source NOx and 10 percent of mobile source $PM_{2.5}$. NESCAUM further stated that it particularly takes note of EPA's conclusion that, barring further controls, $PM_{2.5}$ emissions from locomotive engines and Category 1 and 2 marine diesel engines will comprise 20 percent of mobile source fine particulate pollution in 2030.

OEC stated that exposure to diesel exhaust is widespread in Oregon, with diesel PM exceeding health benchmarks in 25 counties.

Letters:
American Lung Association of Metropolitan Chicago OAR-2003-0190-0518 (hearing)
California Air Resources Board (CARB) OAR-2003-0190-0596.1
Environmental Defense OAR-2003-0190-0487 (hearing), 0592.1
National Association of Clean Air Agencies (NACAA) OAR-2003-0190-0495 (hearing)
Natural Resources Defense Council (NRDC) OAR-2003-0190-0489 (hearing)
North Carolina Division of Air Quality (NCDAQ) OAR-2003-0190-0565.1
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0551.1
Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, Northwest District Association Health and Environment Committee OAR-2003-0190-0593.1
Oregon Environmental Council OAR-2003-0190-0652
People for Puget Sound OAR-2003-0190-0649
Port of Seattle OAR-2003-0190-0469.1
Puget Sound Clean Air Agency OAR-2003-0190-0484 (hearing)
Southwest Clean Air Agency OAR-2003-0190-0468
Texas Commission on Environmental Quality (TCEQ) OAR-2003-0190-0612.1

Our Response:

We appreciate the comments that these commenters provided. We agree with commenters that emissions from nonroad engines account for substantial portions of the country's ambient PM and NOx levels. We estimate that today these engines account for about 25 percent of total NOx emissions and about 35 percent of total direct PM emissions. We believe that reducing emissions from locomotive and marine engines is critically important.

With expected growth in the locomotive and marine sector, the relative emissions contribution from nonroad diesel engines without today's final rule is projected to be approximately 65% of the mobile source diesel $PM_{2.5}$ and 35% of the mobile source NOx emissions in 2030. Locomotives and marine diesel engines designed to the standards finalized in this rulemaking will achieve PM reductions of 90 percent and NOx reductions of 80 percent, compared to engines meeting the current Tier 2 standards. We also note that we are finalizing this program on the same time frame as we proposed in the NPRM.

2.3.1 Protection of Public Health and NAAQS Attainment

What Commenters Said:

CARB stated that the Los Angeles region (South Coast) is in non-attainment for both $PM_{2.5}$ and ozone, and attainment requires extensive emission reductions from all sources.

Environmental Defense, NRDC, et al. commented that while they support the proposed locomotive standards (Table III-1 and Table III-2 of the NPRM), they strongly encourage EPA to secure deeper NOx reductions more quickly than proposed. The commenters stated that finalizing a proposal that will reduce NOx as much and as quickly as possible will give help U.S. cities and states to meet maintain the NAAQS.

Environmental Defense, NRDC, et al. commented that nationwide monitoring data indicate that 88 million people in 208 countries are currently exposed to levels of fine particles that exceed the national health-based air quality standard. The commenters stated that more than half of the American population lives in communities out of compliance with the nation's current health-based ambient air quality standards for ozone and particulate pollution (OAR-2003-0190-0592.1, p.6). The commenters noted that states and localities across the United States are working to clean the air and protect the health of their citizens. Because both locomotives and ships are significant contributors to the NOx and $PM_{2.5}$ emission inventories in many nonattainment areas, reducing their emissions engines will help states and local governments meet their Clean Air Act obligations and restore healthy air.

NACAA noted that this proposal comes at a time when states and localities across the U.S. face the challenge of developing strategies to achieve and maintain health-based NAAQS for ozone and $PM_{2.5}$. The commenter also noted that air quality in approximately 120 areas of the nation currently violate the 8-hour ozone and/or $PM_{2.5}$ standards, exposing well over 150 million people to unhealthful levels of air pollution. The commenter stated that clear that considerable efforts by EPA and state and local agencies will be needed to reduce the health and environmental impacts of sources of pollution contributing to these widespread problems. The commenter noted that EPA has already taken action to tighten the $PM_{2.5}$ ambient air quality standard and is considering similar action for the ozone standard; thus, the commenter stated, increasing the potential challenges facing states and localities.

ALA noted that in its recent annual State of the Air Report, the data reveal a split picture along either side of the Mississippi River, as particle pollution (soot)—"the most dangerous pollutant"—increased in the East but decreased in the West, while ozone (smog) decreased nationwide from peaks reported in 2002. The commenter noted that the number of counties scoring an A grade for ozone levels increased from 82 in 2000 to 145 this year, but particle pollution levels show an ominous trend, with F grades nearly doubling in just one year. The commenter noted that the estimates in its report show that 46% of the U.S. population (136 million people) lives in 215 counties where they are exposed to unhealthful levels of ozone or particulate air pollution; and about 38.3 million Americans live in 32 counties with unhealthful levels ozone and both short-term and year-round particle pollution. The commenter stated that it believes that today, 37 years after the passage of the Clean Air Act (CAA), we should be seeing much greater reductions of pollution levels.

The Puget Sound Clean Air Agency further stated that it believes that achieving reductions in diesel emissions is critical to managing ozone and fine particle pollution levels and related public health risks - especially in areas that will soon fall out of attainment in the Puget Sound region. The commenter noted that the Central Puget Sound region will have one or more nonattainment areas for the revised $PM_{2.5}$ NAAQS and will benefit substantially from emission reductions due to more stringent standards for locomotive and inland marine engines. The region is in marginal attainment of the current ozone standard. Any further tightening of the ozone standard by EPA is very likely to put us in nonattainment. Again, more stringent standards for locomotives and inland marine engines will help us address potential nonattainment challenges.

The City of Houston Bureau of Air Quality Control (BAQC) noted that air pollution impacts the health and welfare of the residents of Houston. The commenter stated that a reduction in ozone precursors like NOx and hydrocarbons (HC) from marine and locomotive engines which will result from these proposed rules will be an important step towards attaining compliance with the ozone NAAQS. Additionally, the commenter noted that reducing $PM_{2.5}$ emissions in the Houston area will help reduce health impacts associated with exposure to $PM_{2.5}$.

SCAQMD noted that the South Coast Air Basin was designated a nonattainment area for the federal annual $PM_{2.5}$ and 8-hour ozone ambient air quality standards and must attain these standards no later than 2015 and 2024, respectively. The commenter stated that, compared to the other national nonattainment areas, the South Coast Air Basin has the highest population-weighted ozone exposure, representing 24 percent of the nation's 8-hour ozone exposure as well as its highest ozone design value. The commenter noted that almost 90 percent of the nation's total population-weighted exposure to fine particulates occurs in California, and 52 percent of the nation's total exposure to fine particulates occurs in the South Coast Air Basin alone. These pollutant exposures result in severe public health impacts in the South Coast Air Basin. At the public hearing, SCAQMD commented that, as proposed, the rule will not provide NOx emission reductions needed in the South Coast region to timely meet its federal attainment deadlines for $PM_{2.5}$.

SCAQMD noted that the region is moving ahead with planning to attain the federal 8-hour ozone and annual $PM_{2.5}$ standards with the recent adoption of the 2007 Air Quality Management Plan (AQMP) for the South Coast Air Basin. The commenter noted that the attainment challenges are significant given that stationary sources are now generally controlled to over 90 percent, and about 80 percent of particulate-related emissions in the Basin are caused by mobile sources. The commenter further stated that national transportation sources such as locomotives, marine vessels, and aircraft represent 24 percent of the emissions contribution to the Basin's air quality problem; and 2007 AQMP computer modeling shows that the Basin cannot timely attain federal air quality standards without significant emission reductions from all sources, in particular, marine vessels and locomotives. The commenter stated that for locomotives, the AQMP relies on advanced technology controls achieving 90 percent plus control for particulates and NOx (a precursor to $PM_{2.5}$) commencing in 2012.

SCAQMD also noted that In addition, the South Coast Air Basin's two major marine ports (Ports of Los Angeles and Long Beach) combined represent the largest marine container port in the U.S. and the fifth largest in the world. The commenter stated that these ports have adopted the San Pedro Bay Ports Clean Air Action Plan (SPBCAAP), which calls for the cleanest locomotives to operate out of the ports—locomotives that are 90 percent cleaner than the existing Tier 2 locomotive emission standards, to be phased in between 2012 and 2014. SCAQMD noted that the Ports are also developing emissions performance standards for new marine vessels and existing marine vessels, which include harbor craft.

A number of private citizens commented that they believe that cleaning up locomotive and marine diesel engines will reduce air pollution and prevent thousands of premature deaths. The commenters stated that they strongly support the clean up of locomotive and marine diesel engines, as the public health benefits from cleaning up diesel engines are enormous; and EPA must act now.

The New York State Department of Environmental Conservation noted that emissions from diesel engines are significant contributors to several important air pollution problems, including ozone formation, fine particulate matter, and toxic air emissions. The commenter noted that it has long advocated applying technology forcing emissions standards to a wide variety of diesel engine applications to reduce their health and environmental impact.

The Wyoming Outdoor Council commented that it believes that full regulation of NOx and PM emissions is essential. The commenter noted that in Wyoming, there are thousands of trains annually moving in and out of the Powder River Basin in the northeast part of the state hauling coal, and thousands more trains traverse the Union Pacific rail line corridor that roughly parallels Interstate 80 across the entire southern part of the state. The commenter noted that air pollution is of increasing concern in Wyoming, ozone levels are increasing even in rural areas, and have reached levels that are at or near the NAAQS for ozone in several areas in Wyoming (such as Yellowstone National Park, where the National Park Service has determined that ozone conditions in are degrading). The commenter further noted that the State of Wyoming has been forced to adopt a Natural Events Action Plan for Coal Mines of the Powder River Basin due to monitored exceedances of the 24-hour NAAQS for PM10 in the Powder River Basin. The Wyoming Outdoor Council commented that it believes that emissions from diesel locomotives are a significant source of air pollution in Wyoming, and are of great concern relative to impacts to the public health and welfare.

The Missouri Department of Natural Resources (MDNR) noted that Kansas City, Missouri is home to one of the largest rail yards in the United States. The commenter also noted that Kansas City and its surrounding Missouri counties are considered to be a maintenance area under the 8-hour standard, and the region has had a history of ozone issues under the previous one-hour standard and current 8-hour standard. The commenter stated that, based on recent air quality data that still needs to be quality assured, Kansas City has violated the 8-hour ozone standard. However, once the violation has been quality assured, additional measures to reduce emissions associated with high ozone levels will need to be implemented; thus the commenter stated that it believes that the reduction of emissions from all types of locomotives will have a positive impact on improving the air quality in the area.

Environmental Defense commented that States across the country are under firm deadlines for achieving cleaner air and EPA's own numbers show that each year of delay is paid for in early deaths, children's asthma attacks, and lost work days that could have been prevented.

NESCAUM commented that it believes that reducing diesel engine emissions to attain federal standards is first and foremost a matter of public health. The commenter also noted that from 2004 and 2006, 117 monitors in the NESCAUM region recorded exceedances of the current ozone NAAQS (0.08 ppm). Further, over the same period, 98 monitors in the NESCAUM region measured exceedances of the daily $PM_{2.5}$ air quality standard. NESCAUM commented that if it is to address these public health needs, additional timely and aggressive programs to reduce NOx and $PM_{2.5}$ are essential. NESCAUM commented that there is the need to reduce locomotive and marine engine emissions in order for states to achieve and maintain air quality standards and reduce public exposure to ozone, particulates, and toxics, but States are preempted from regulating locomotive and new marine engine emissions. The commenter stated that it therefore strongly urges EPA to finalize the emission standards by the end of 2007.

NRDC stated that these diesel engines hamper state and local efforts to attain and maintain EPA's NAAQS for PM and ozone.

The San Joaquin Valley Unified Air Pollution Control District commented that significant progress has been made in improving air quality in the region. However, the commenter noted, the region faces a daunting challenge in meeting federal ambient air quality standards for ozone and particulates. The commenter stated that meeting the health-based 8-hour ozone standard will require another 75% reduction in emission of NOx from 2005 levels. The commenter further stated that, since the regulation of locomotive emissions falls under the authority of the federal government, it strongly supports the implementation of the most effective rule that will control locomotive emissions to the full extent required by the Clean Air Act as expeditiously as possible. The commenter urged EPA to assure that locomotive NOx emissions in the San Joaquin Valley are reduced by at least 75% from 2005 levels; as, without this level of reduction from all of the Valleys significant NOx source categories, the Valley will not attain the current or proposed ozone NAAQS.

NCDAQ noted that the portions of North Carolina where marine vessel emissions occur do not currently have problems with high levels of ozone or fine particulate, the commenter stated that it believes the proposed controls for marine diesel engines will help maintain good air quality in these coastal areas into the future and therefore are welcomed by NCDAQ.

Letters:
American Lung Association OAR-2003-0190-0509 (hearing)
California Air Resources Board (CARB) OAR-2003-0190-0596.1
City of Houston Bureau of Air Quality Control (BAQC) OAR-2003-0190-0561.1
Environmental Defense OAR-2003-0190-0487 (hearing)
Environmental Defense, NRDC, et al. OAR-2003-0190-0592.1
Missouri Department of Natural Resources, Air Pollution Control Program (MDNR) OAR-2003-0190-0658
National Association of Clean Air Agencies (NACAA) OAR-2003-0190-0495 (hearing)
Natural Resources Defense Council (NRDC) OAR-2003-0190-0489 (hearing)
New York State Department of Environmental Conservation, Office of Air Resources OAR-2003-0190-0583.1
North Carolina Division of Air Quality (NCDAQ) OAR-2003-0190-0565.1
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0551.1
Private Citizens (*various*)
Puget Sound Clean Air Agency OAR-2003-0190-0484 (hearing)
San Joaquin Valley Air Pollution Control District OAR-2003-0190-0556.1
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0558.1
Wyoming Outdoor Council OAR-2003-0190-0467

Our Response:

We agree that the rule is a crucial component of the effort to meet health based air quality standards, such as the NAAQS. For the final rule we project that reductions of $PM_{2.5}$, NO_x, and volatile organic compound (VOC) emissions from locomotive and marine diesel engines will produce nationwide air quality improvements. According to air quality modeling performed in conjunction with this rule, all 39 current $PM_{2.5}$ nonattainment areas will experience a decrease in their projected 2030 design values. Likewise the 134 mandatory class I federal areas that were modeled will all see improvements in their visibility. This rule will also result in nationwide ozone benefits. In 2030, 573 (of 579) counties experience at least a 0.1 ppb decrease in their ozone design values. Also, see Sections 3.1.1 and 3.2.1 for further discussion on the timing and stringency of the standards.

2.3.2 Near Port/Railyard/Shipping Lanes and Environmental Justice

What Commenters Said:

The Puget Sound Clean Air Agency commented that rail and marine activities in the central Puget Sound region generate significant fine particle pollution; and further cited the Puget Sound Maritime Emission Inventory, which stated that “harbor craft” (vessels that would be affected by the EPA proposal) are responsible for 14% of the regional diesel PM and 2% of the region’s total $PM_{2.5}$ emissions. The commenter stated that these percentages are based on total regional contributions and the contributions of inland marine and locomotive engines are much greater in neighborhoods near ports and rail yards where these emissions are concentrated. The commenter also noted that the rapid increase in Asian trade could double the current number of containers at the Port of Seattle, and increase by 4 to 5 times the current number of containers at the Port of Tacoma over the next ten to twenty years; resulting in very large increases in both total mass emissions and the percentage contribution of these sources to our regional NOx, SOx, PM and diesel particulate emissions.

NESCAUM commented that it is concerned about the impacts on public health from direct, short-term exposure to locomotive and marine diesel emissions. The commenter cited recent Clean Air Task Force reports which found that ultrafine particle levels inside commuter train coaches, where the locomotive is leading the train, have been measured at levels as much as 17 times higher than what is measured in the ambient air. The commenter also stated that $PM_{2.5}$ and ultrafine particle levels in ferry passenger compartments average about three times the simultaneous levels in the ambient air, and levels of polycyclic aromatic hydrocarbons and black carbon in ferry passenger compartments are even higher relative to the ambient air.

NRDC also commented that it believes that locomotive and marine diesel pollution disproportionately affects the people and communities who live closest to the rail yards and ports. The commenter stated that in those communities, exposure to these emissions is likely to be far greater; and many of these communities are low-income and/or communities of color, giving rise to significant environmental justice concerns that underlie its interest in this rule-making.

People for Puget Sound cited recent studies by CARB that have shown elevated cancer risk for populations living near rail yards. The commenter noted that in the city of Commerce, risk is increased by 69 percent, and other human health impacts such as heart and other diseases have also been shown to be increased due to fine particulate pollution.

SCAQMD noted that diesel PM emissions from railyards and ports also have been found to cause significant cancer risks in neighboring communities.

Environmental Defense, NRDC, et al. commented that the presence of pollution ‘hot spots’ resulting from geographical density of ships and trains (e.g., rail yards and ports) challenges the capacity to equally protect human health -highlighting just how important it is to clean up these high polluting engines. The commenters stated that locally, ship emissions can have a major impact on air quality. The commenters noted that areas like Houston-Galveston, Los Angeles, and Baton Rouge have serious ozone problems and heavy shipping traffic. The commenters noted that SCAQMD’s emissions inventory shows that oceangoing ships, tugs and other commercial watercraft collectively emit 48 tons a day of smog-forming NOx in the Los Angeles area. The commenters also cited an Environ International Corporation report

("Commercial Marine Emission Inventory Development", April 2002) which estimated that in the Lower Mississippi area commercial marine vessels emit 23,204 tons of NOx each year, and in the Houston-Galveston area ports ships emit 8,810 tons of NOx each year.

The commenters also stated that the major marine port facilities in California contribute a great deal to overall regional pollution as well as create local pollution hot spots in the communities nearby. A recent CARB study of diesel pollution from port terminals in Los Angeles and Long Beach concluded that cancer risks associated with this pollution exceeded 500 in a million. In fact, the same study indicated that cancer risks remained elevated, at 50 per million, as far as 15 miles away from the terminals. The CARB study also estimated a number of non-cancer health impacts from the two ports, including 67 premature deaths and 41 hospital admissions for respiratory and cardiovascular causes in 2005 alone.

Environmental Defense, NRDC, et al. also commented that emissions from commercial marine vessels are not restricted to port areas. The commenters stated that nearly all emissions in U.S. waters occur in shipping channels outside of port regions; and provided the example that in Santa Barbara County—up the West Coast from Los Angeles area ports but next to major shipping lanes—the 1999 emissions inventory indicated that ships emit more than 29 tons of NOx each day, well more than the almost 26 tons of NOx from on-road motor vehicles in the county. The commenters noted that air toxics are also a concern for marine ports and shipping channels, citing a recent study by the University of Texas which identified increased incidence of leukemias in children living within two miles of the Houston Ship Channel compared to those living from 2-10 miles from the Ship Channel. Preliminary data indicates that the leukemia is associated with exposure to 1,3-butadiene in the diesel exhaust, and the levels of benzene in the Channel's vicinity are also a concern. The commenters noted that in 2003, EPA made Tier 1 standards mandatory for many engines, and added some other requirements for some engines, but these standards yielded only a 27% NOx reduction for Category 1 and 2 engines (paling in comparison with the 90-95 percent reductions that were required in EPA's highway and truck rules that were being developed at roughly the same time).

The commenters state that the locomotives and off-road equipment used at rail yards can be extremely polluting and are especially problematic where these yards are in or close to residential areas. In 2004 the California Air Resources Board published the results of a health risk assessment for airborne particulate matter emissions from diesel-fueled locomotives at the Union Pacific J.R. Davis Yard (Yard) located in Roseville, California. The Roseville rail yard is a 950-acre facility surrounded by commercial, industrial, and residential development. Being the largest rail yard in the West with over 30,000 locomotives moving through the facility each year, it is an ideal case study for the evaluation of localized health risks associated with diesel pollution.

With regard to locomotive hot spots, the commenters noted that a 2004 CARB report estimated diesel PM emissions from locomotive operations at the Union Pacific J.R. Davis Yard in Roseville, CA averaged approximately 25 tons per year. The commenters noted that moving locomotives accounted for half of the emissions, idling locomotives accounted for about 45 percent, and locomotive testing accounted for about 5 percent of the total diesel PM emissions.

Using computer modeling, predicted cancer risks were above 500 per million (based on 70 years of exposure) in the neighborhoods receiving the highest exposures, affecting an estimated 500 - 700 people. Cancer risk levels between 100 and 500 per million affect 14,000 to 26,000 people and cancer risk levels between 10 and 100 in a million affect approximately 140,000 to 155,000 people. These cancer risks are in addition to the regional background cancer risk, which is 360 per million (CARB 2004). Recent health risk assessment studies done by the major rail companies in conjunction with CARB indicate similarly high risk levels of up to 1,000 per million impacting over 5,000 residents near the Commerce rail yards. While most railyards do not pose as great a health risk as the Roseville rail yard, the CARB studies demonstrate that the 10 rail yards evaluated in addition to Roseville contribute nearly 70 tons of diesel PM to the atmosphere each year. Depending on the specific conditions surrounding these rail yards, locomotive PM emissions place thousands of lives at risk. For example, at the BNSF Railyard, located in Hobart, California, CARB estimated that 7,000 people are exposed to railyard-related diesel particulate matter at concentrations that result in cancer risks up to 500 per million, whereas nearly 7,000 people living adjacent to the BNSF Railyard in Richmond, California experience increased cancer risks of 10 - 25 per million. The commenters noted the Draft RIA estimates that locomotives were responsible for more than 31,000 short tons of $PM_{2.5}$ and more than 942,000 short tons of NOx. The commenters also noted that currently more than 22,000 freight and 270 passenger locomotives operate in the U.S., and approximately 100,000 miles of track crisscross the country (see OAR-2003-0190-0592.1, p. 16 for map).

The commenters also note that hundreds of thousands of Californian's live close enough to ports and rail facilities to suffer highly elevated exposures to this pollution. Millions of other Californians live further downwind from these facilities but still have elevated risks. CARB recently published studies to quantify risks from mobile source emissions of diesel PM. One study covers emissions from the combined ports of Los Angeles and Long Beach. The second covers one of California's largest railyards located in Roseville, a suburb northeast of Sacramento. CARB just released draft similar studies for ten additional railyards and are currently developing a study for the Port of Oakland to be released as a draft this fall. Seven additional railyard studies are scheduled to be completed by the end of this year.

The commenters and CARB all noted that the Health Risk Assessment (HRA) for the Los Angeles / Long Beach ports determined that the elevated cancer risk from all port-related PM emissions is greater than 500 cases per million cases for approximately 50,000 people who reside within up to two miles of the ports and a risk of greater than 10 cases per million for about eight million residents within about 60 miles. The commenters further stated that Category 1 and 2 marine engine emissions in commercial harbor craft produce a significant fraction of port-related exposure. The HRA estimated that the commercial harbor craft contribution to these emissions (NOx & PM) produce an elevated cancer risk of greater than 200 cases per million for about 5,000 residents and greater than 10 cases per million for about 1.5 million residents.

<u>Letters:</u>

California Air Resources Board (CARB)   OAR-2003-0190-0596.1
Environmental Defense, NRDC, et al.   OAR-2003-0190-0592.1
Natural Resources Defense Council (NRDC)   OAR-2003-0190-0489 (hearing)

Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0551.1
People for Puget Sound OAR-2003-0190-0649
Puget Sound Clean Air Agency OAR-2003-0190-0484 (hearing)
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0558.1

Our Response:

In regards to the comments related to near rail yard, near port, and/or environmental justice, the EPA has appropriately addressed these items in Sections II, IX.G, and IX.J of Preamble as well as Chapters 2 and 6 of the Final RIA.

In short, EPA recently conducted an initial screening analysis of selected marine port areas and rail yards to begin to understand the populations living near rail yards and marine ports. This screening analysis indicated that at the 40 marine ports and 37 rail yards studied, at least 13 million people, including 3.5 million children and a high percentage of low-income households, African-Americans, and Hispanics, living near these facilities, are being exposed to elevated levels of diesel particulate matter. These populations will benefit from the controls being finalized in this action because this rulemaking increases the level of environmental protection for all affected populations.

With regard to children, the screening analysis shows that the age composition of the total affected population near both the marine ports and rail yards matches closely the age composition of the overall U.S. population. However, for some individual facilities the young appear to be over-represented in the affected population compared to the overall U.S. population. See section VI of the preamble to the final rule and Chapters 2 and 6 of the RIA for a discussion on the air quality and monetized health benefits of this rule, including the benefits to children's health.

This rulemaking will achieve significant reductions of various emissions from locomotive and marine diesel engines, including NOx, PM, and air toxics. These pollutants raise concerns regarding environmental health or safety risks that EPA has reason to believe may have a disproportionate effect on children, such as impacts from ozone, PM, and certain toxic air pollutants.

EPA has evaluated several regulatory strategies for reductions in emissions from locomotive and marine diesel engines, and we believe that we have selected the most stringent and effective control reasonably feasible at this time (in light of the technology and cost requirements of the Clean Air Act). The programs being finalized today address both new engines and existing fleets of engines which will benefit the populations, including children, minority, and low-income populations, who live in proximity to marine ports and rail yards. In fact, the emission reductions from the stringent new standards finalized in the locomotive and marine diesel rule will have large beneficial effects on communities in proximity to port, harbor, waterway, railway, and rail yard locations, including children, low-income, and minority communities. In addition to stringent exhaust emission standards for new and remanufactured engines, the final rule includes provisions targeted to further reduce emissions from regulated engines that directly impact low-income and minority communities. The idle reduction provision is one example: "Even in very efficient railroad operations, locomotive engines spend a substantial amount of time idling, during which they emit harmful pollutants, consume fuel, create noise, and increase maintenance costs. A significant portion of this idling occurs in rail yards, as railcars and locomotives are transferred to build up trains. Many of these rail yards are in urban neighborhoods, close to where people live, work, and go to school" (from preamble section III.C(1)(c)). The final rule includes a mandatory locomotive idle reduction requirement that will begin to take effect as early as 2008. Another example is the emission standards for newly-built switch locomotives. Switch locomotives are major polluters in urban rail yards. These standards are earlier and more stringent than the line-haul locomotive standards, and include incentives for introducing cleaner switchers using Tier 4 nonroad engines. Further examples can be found in averaging, banking, and trading program provisions aimed at ensuring that emissions are not shifted from line-haul locomotives operating in rural areas to rail yards in urban communities.

2.3.3 Benefits of Emissions Reductions from Locomotive and Marine Engines

What Commenters Said:

Nationwide, using EPA's methodology, Environmental Defense estimated that the 2006 particulate and NOx emissions from locomotives will be associated with more than 3,000 premature deaths this year. Exposure to this pollution may also contribute to, among other health effects, more than 4,000 non-fatal heart attacks, approximately 61,000 cases of acute bronchitis and exacerbated asthma in children, and nearly 290,000 lost workdays. The economic impact of these adverse health effects will total over $23 billion this year.

Last year, NACAA published a study in which they estimated that emissions from locomotives and marine diesel engines are responsible for more than 4,000 premature deaths each year, as well as a host of other serious public health and welfare consequences (*Danger in Motion: It's Time to Clean Up Trains and Boats, February 2006*).

The Oregon Department of Environmental Quality noted that in February 2006, NACAA (of which Oregon is an active member) issued a report estimating that emissions from commercial marine and locomotive engines may account for more than 4,000 premature deaths per year, as well as a multitude of other health and environmental impacts.

The Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, and Northwest District Association Health and Environment Committee cited a study in which the National Association of Clean Air Agencies (NACAA) estimated the current number of premature deaths from locomotive and marine diesel emissions to be about 4,000. (*Danger in Motion: It's Time to Clean Up Trains and Boats, February, 2006.*)

A group of private citizens noted that State and local air pollution control directors estimate that locomotive and marine diesel emissions are responsible for 4,000 premature deaths and 2,000 ER visits for children with asthma attacks annually. The commenters stated that the public health benefits from cleaning up diesel engines are enormous, and they believe that all diesel engines - including locomotive and marine engines - should be cleaner to help improve air quality so all Americans can have air that is safe to breathe. The commenters stated that they believe EPA must act now.

The Wisconsin Department of Natural Resources (WDNR) commented that it believes that locomotive and marine diesel engines are among the largest and most dangerous under-regulated sources of pollution in the U.S. The commenter noted that the 2006 NACAA study estimates that locomotives and marine diesel engines are responsible for more than 4000 premature deaths each year, as well as other serious public health and welfare consequences. The commenter believes that the rule will significantly reduce harmful emissions of diesel PM and NOx emissions from these engines.

Several private citizens commented that because soot from trains and boats causes lung cancer, heart attacks, chronic bronchitis, asthma attacks, and premature deaths, cleaning up these two sources now will prevent over 4,000 deaths annually and reduce cases of the other aforementioned health problems.

NRDC noted that state and local air regulators estimate that cleaning up these engines will prevent more than 4,000 premature deaths a year.

The Oregon Environmental Council noted that the Oregon Department of Environmental Quality calculates that the public health and environmental impacts of diesel pollution cost Oregonians nearly $2 billion a year in rising health insurance costs, costs to employers and costs to taxpayers associated with respiratory and cardiovascular hospitalizations, lost work days, and premature deaths triggered by diesel pollution.

<u>Letters:</u>
Environmental Defense, NRDC, et al. OAR-2003-0190-0592.1
National Association of Clean Air Agencies (NACAA) OAR-2003-0190-0495 (hearing)
Natural Resources Defense Council (NRDC) OAR-2003-0190-0489 (hearing)
Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, Northwest District Association Health and Environment Committee OAR-2003-0190-0593.1
Oregon Department of Environmental Quality, Air Quality Division OAR-2003-0190-0506 (hearing)
Oregon Environmental Council OAR-2003-0190-0652
Private Citizens (*various*)
Wisconsin Department of Natural Resources, Bureau of Air Management OAR-2003-0190-0552

Our Response:

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 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. EPA projects these reductions will annually prevent up to 1,100 PM-related premature deaths, 280 ozone-related premature deaths, 120,000 lost work days, 120,000 school day absences, and 1.1 million minor restricted-activity days.

2.4 Other

2.4.1 Reducing Air Pollution from Locomotives

What Commenters Said:

Tacoma Public Utilities noted that Tacoma Rail is a utility within Tacoma Public Utilities. Tacoma Rail has 73 customers, most of them located in the Tideflats Division (which serves the Port of Tacoma's main facilities on Commencement Bay) and operates 18 diesel locomotives. The commenter noted that Tacoma Rail has worked to reduce air emissions in a number of ways in recent years, such as the reduction of particulate air emissions since November 2005 through exclusive use of the Eco-Tip Super-Stack Fuel Injectors. The commenter also noted that in June 2006, Tacoma Rail converted to the use of ultra-low sulfur diesel (ULSD) to reduce air emissions, and has installed idle reduction systems using a combination of Diesel Driven Heating System (DDHS) and Smart Start System (electronic start and stop) to reduce overall idle time on four of its locomotives. Tacoma Public Utilities commented that it believes this will reduce significantly overall emissions and diesel fuel emissions; and the commenter looks forward to working with EPA on environmentally sound and cost-effective measures to reduce air pollution from locomotion activities.

<u>Letters:</u>
Tacoma Public Utilities OAR-2003-0190-0517

Our Response:

EPA believes that this final rule is both environmentally sound and cost-effective. EPA also looks forward to working with Tacoma Public Utilities, and other members of the American public, on environmentally sound and cost-effective measures to reduce air pollution.

2.4.2 Emissions from Offshore Vessels

What Commenters Said:

The Offshore Marine Service Association (OMSA) noted that offshore vessels operate primarily offshore, outside of territorial waters, at distances of up to 200 miles offshore. The commenter stated that these vessels typically operate from remote shore-based locations with limited emission sources and outside non-attainment areas; and as such, offshore support vessels provide a minimal contribution to the exhaust emissions this rule is designed to address.

Crowley Maritime Corporation (Crowley) commented that it believes EPA should recognize the need to establish more stringent air emission standards near populated coastal zones with serious air quality issues than on the high seas and other areas. Crowley stated that while it supports regulations to be implemented on an international level rather than on a local level, CARB requirement to switch from residual fuel to diesel fuel 24 miles offshore for the high density area populated of large California ports may have merit. The commenter stated that these measures would of course be considered excessive for ports in less populated areas; these stricter standards needed for those identified coastal zones do not need to be required in all coastal areas of the high seas.

Letters:

Crowley Maritime Corporation	OAR-2003-0190-0641
Offshore Marine Service Association	OAR-2003-0190-0611.1

Our Response:

Although offshore vessels can operate from remote locations and outside non-attainment areas, EPA believes that emissions from offshore vessels still have a negative impact. In the preamble we note that emitted particles can remain in the atmosphere for days to weeks and travel through the atmosphere hundreds to thousands of kilometers. We also state that ozone can be transported into an area from pollution sources found hundreds of miles upwind.

2.4.3 "Green" Transportation—Waterborne Commerce

What Commenters Said:

The Lake Carriers' Association (LCA) noted that in the early 1990s, LCA, and other members of the Great lakes maritime community, commissioned a study of the environmental benefits of Great lakes shipping and the impacts of switching to land-based modes of transportation. The commenter stated that the findings were conclusive—utilizing ships and tug/barge units had the fewest environmental impacts. The commenter noted the following examples:

- For the 11 commodity movements studied, the shifting of 25 million tons of cargo from vessel to rail would result in the additional consumption of 14 million gallons of fuel and the generation of an extra 4,321 ton of carbon monoxide (CO), HC, and NOx pollutants.
- For the rail movements, total fuel use was 44 percent greater than for the marine movements. Vessel fuel efficiencies were considerably higher in some of the movements, ranging up to 100 percent greater than for rail.

- Total rail emissions were more than 47 percent greater than for the marine movements.
- In the three commodity flows where truck transportation was a feasible alternative to vessel delivery, the shifting of less than one million tons of waterborne cargo to highway would increase fuel consumption by 3.4 million gallons and generate an additional 570 tons of air pollutants.

Letters:
Lake Carriers' Association (LCA) (0567.1)

Our Response:

EPA appreciates the comment. The commenter did not provide a copy of the report cited above, and EPA does not have a copy, and as the analysis for this rule does not include a comparison of land and marine based transportation, we are unable to comment on its conclusions.

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3. EMISSION STANDARDS

What We Proposed:

The comments in this section correspond mainly to Section III of the preamble to the proposed rule, and are therefore targeted at the proposed emissions standards for locomotives and marine diesel engines. A summary of the comments received, as well as our response to those comments, is located below.

3.1 Locomotives

3.1.1 Standards and Timing

What Commenters Said:

Set Accelerated or More Stringent Standards

The Northeast States for Coordinated Air Use Management (NESCAUM) commented that it strongly encourages EPA to implement the Tier 3 standard by no later than the end of 2010, rather than the proposed 2012 date. The commenter also encouraged EPA to require Tier 4 emissions levels for both oxides of nitrogen (NOx) and particulate matter (PM) by no later than the end of 2013, rather than the respective proposed dates of 2017 and 2015. The commenter expressed support for the proposed Tier 3 0.10 g/bhp-hr PM standard and Tier 4 emissions levels that are at least as stringent as the proposed 1.3 g/bhp-hr for NOx and 0.03 g/bhp-hr for PM.

National Association of Clean Air Agencies (NACAA) recommended that the implementation dates for new engine and remanufacture standards be accelerated. The commenter noted that technical experts within NACAA (including those from the California Air Resources Board (CARB) and the South Coast Air Quality Management District (SCAQMD)) believe that Tier 4 NOx and PM standards for new engines at least as stringent as those proposed are technologically feasible by the end of 2013, the Tier 3 PM standard for new locomotives can be implemented no later than the end of 2010, and the Tier 2 remanufacture standard for PM can be implemented by the end of 2010. NACAA recommended that EPA advance the rule's implementation dates accordingly.

Clean Air Watch urged EPA to finalize the rule by the end of 2007; the commenter stated that "each year of delay means more death and disease." The commenter also requested that the Tier 4 NOx standards be made final no later than 2015. The commenter expressed a view that EPA can do a better interim cleanup job, and urged EPA to set Tier 3 NOx standards for locomotive engines by 2012 at the latest.

The New Jersey Department of Environmental Protection (NJDEP) recommended that the proposed locomotive emission standards implementation schedule be accelerated, based on the rationale outlined by NESCAUM and NACAA. The commenter said that the Tier 3 and Tier 4 emission standard implementation schedule should be shortened. NJDEP commented that it supports the proposed 0.10 g/bhp-hr Tier 3 PM emission standard requirement for new locomotives by the end of 2010 instead of 2012. The commenter also expressed support for the proposed Tier 4 1.3 g/bhp-hr NOx emissions standard and 0.03 g/bhp-hr PM standard for new locomotives by the end of 2013, rather than 2017 and 2015, respectively. NJDEP commented that most of EPA's rationale for the proposed standards timetable is due to current technology and future technology assumptions. The commenter noted that it hired an expert in the field of diesel emission reduction technology; this expert developed a report (OAR-2003-0190-0562.3) which demonstrates that the technology is well enough along to support an accelerated timetable.

The Clean Air Task Force (CATF) commented that Tier 4 NOx and PM standards for both ships and trains should be fully implemented by 2015. The commenter requested that EPA finalize the rule as soon as possible, but no later than December 2007. The commenter stated that the rule has been delayed too long already, and any further delay would simply prolong the severe human health and environmental impacts caused by under-regulated marine and locomotive diesels. The commenter also requested that the Tier 3 NOx standards be required by 2012.

The Missouri Department of Natural Resources (MDNR) recommended shortening the time period until the implementation of both the new engine emission standards and remanufactured engine emission standards for locomotives. The commenter requested that the standards be implemented as soon as they are technically feasible to allow for emissions reductions as soon as possible.

The Puget Sound Clean Air Agency commented that it believes that it is critical for EPA to implement this rule according to the time schedule outlined in the Notice of Proposed Rulemaking (NPRM). The commenter urged EPA to finalize the rule by the end of 2007; and commented that the package can be improved significantly by advancing the dates on which new and remanufactured engine standards are implemented.

The American Lung Association (ALA) and the ALA of Metropolitan Chicago commented that they believe EPA should require Tier 3 locomotives to reduce NOx by at least a 50 percent as soon as possible, and no later than 2012.

The Natural Resources Defense Council (NRDC) commented that, given the urgent public health need and the adaptability of highway and nonroad emission control technologies to the locomotive and marine diesel sectors, the clean-up is necessary, feasible, and overdue. The commenter stated that it agrees with the proposed timing (voluntary rebuilds in 2008, mandatory rebuilds in 2010, Tier 3 emission standards in 2012, and Tier 4 emission standards beginning 2015), and urged EPA to finalize the rule in 2007. NRDC also commented that it is critical for EPA to finalize the rule in 2007 so industry can have the certainty it needs to develop cost-effective products that meet the agency's standards and timetables, and so the rebuild and other early components of the program can go forward on the expedited schedule that states, cities, and the public's health requires. The commenter stated, however, that EPA should speed up the introduction of Tier 4 engines and harmonize the introduction of the PM and NOx standards in all cases: the commenter suggested that Tier 4 PM and NOx standards be required to be fully implemented as soon as possible and no later than 2015 (as "each year of delay between Tier 3 and Tier 4 adds an additional 700 tons of soot and 40,000 tons of smog-forming gases") and that the Tier 3 standards for PM and NOx be implemented no later than 2012. The commenter also noted that it encourages relying on cooled exhaust gas recirculation (EGR), as it would enable a 50 percent reduction.

NRDC also commented that EPA should strengthen the program to clean up existing engines by requiring existing train engines to be cleaner when they are rebuilt, as soon as possible and no later than 2010 for any locomotive engine (versus waiting until 2013 to make the clean-up of all existing locomotive engines mandatory, as proposed in the NPRM. NRDC also cited Wall Street Journal comments made by Electro-Motive Diesel, Inc. (EMD) in which it stated that "…we're definitely intending to meet all of the [EPA] rules and requirements." NRDC commented that EMD's statement shows that the proposed standards and timetables are feasible.

The Wisconsin Department of Natural Resources (WDNR) requested that EPA accelerate the implementation dates for emission standards for new and remanufactured locomotives.

CARB commented that it supports setting Tier 4 locomotive and marine requirements based on the best possible emissions aftertreatment control technologies at emission reduction levels similar to those currently required on highway and nonroad diesel engines, and applying the most effective Tier 3 standards possible while the Tier 4 technologies are being developed.

CARB commented that it believes that Tier 4 NOx standards for freight line-haul locomotives should be applied concurrently with the introduction of the Tier 4 PM standards. The commenter noted that General Electric Transportation (GE) and EMD were able to develop the redesigned Tier 2 line-haul locomotives in the 1998-2004 timeframe. The commenter noted that this process included time for extensive in-use testing in 2003 and 2004, and occurred while Tier 0 and Tier 1 locomotive engine upgrades and redesigns were accomplished simultaneously between 1999 and 2002. The commenter also noted that, at the same time, GE and EMD and other manufacturers were developing numerous Tier 0 remanufacturing kits (over 90) for EPA to certify from 1994-2006. CARB commented that, based on the NPRM's indication that diesel particulate filter (DPF) and Selective Catalytic Reduction (SCR) have been demonstrated to be mature and cost-effective for other mobile sources and that most of the research and experience gained from DPF and SCR on highway and other nonroad engines can be applied to locomotives, it believes that within six years (by the end of 2014 at the latest) the necessary research (already underway), design, and bench and in-use testing should be completed so that new Tier 4 NOx and PM line-haul locomotives are fully commercially available by 2015.

CARB commented that it believes that Tier 3 standards for line-haul locomotive PM reductions of 50 percent no later than 2012 are appropriate, but suggested a concurrent NOx reduction requirement of at least 50 percent. The commenter also requested that NOx reduction requirements be applied when Tier 3 PM requirements are introduced in 2012, stating that EPA has already determined that similar NOx reductions are technically feasible and cost-effective for large engines in other nonroad categories by 2011. CARB commented that it believes a Tier 3 line-haul locomotive NOx standard of 3.0 g/bhp-hr is feasible without aftertreatment, and that this standard would be an essential element of California's efforts to attain the ozone and PM standards. The commenter noted that diesel PM reductions from Tier 2 locomotives are especially important in California. The commenter noted that it has emission reduction agreements with the railroads, thus California will have an accelerated introduction of Tier 2 locomotives by 2010. CARB urged that the Tier 2 locomotive PM remanufacturing standard be required earlier than the 2013 proposed date, as it believes that the needed technologies will be available for the Tier 3 engines by 2012, if not earlier. The commenter stated that a delay to 2013 could cause some older Tier 2 locomotives to be rebuilt to the less-protective original PM standard, delaying health benefits another five to seven years. CARB commented that it believes that acceleration of the initial compliance dates is technically possible, and needs to be required at the earliest feasible date.

The Ozone Transport Commission (OTC) commented that its member states encourage EPA to examine the effective dates for many of the standards proposed. The commenter recommended that EPA finalize a 2013 deadline for the proposed Tier 4 locomotive standards.

SCAQMD commented that, based on its own research and commercialization efforts on advanced emission control technologies and deployment of cleaner alternative fuels and diesel fuel alternatives under the SCAQMD Clean Fuels Program, the proposed compliance schedules can be substantially accelerated. SCAQMD commented that it strongly urges EPA to move up the proposed Tier 4 standard for new locomotive engines to June 2012 (at the latest), when ultra low sulfur diesel (ULSD) will be required for locomotives. The commenter noted that the proposed dates for new locomotive Tier 4 PM engine standards fall in the deadline year for the South Coast region and the San Joaquin Valley to meet the federal annual PM2.5 air quality standard. The commenter stated that the proposed deadline is too late to provide any assistance in meeting the federal annual PM2.5 standard, given that the proposed advanced control standards for locomotives only apply to new units and the resulting need to allow time for fleet turnover before benefits are realized. SCAQMD also commented that the proposed 2017 date for the Tier 4 NOx standard is well beyond the attainment date of the federal annual PM2.5 air quality standard; the commenter noted that NOx is a precursor to particulates, and believes it must be substantially controlled in order for the region to attain the PM2.5 standard. The commenter further suggested that the implementation date for the Tier 3 standards be moved to the end of 2010.

SCAQMD commented that, if EPA concludes that it cannot require all new locomotives to be Tier 4 by June 2012 nationally, it urges that EPA adopt Tier 4 standards to begin by the end of 2013 and the other SCAQMD proposed deadlines detailed in its comments nationwide, but provide cleaner (Tier 4) engines by June 2012 for those areas that truly need the earlier reductions (e.g., Southern California and other areas with significant locomotive activities). The commenter stated that such a rule would greatly help the South Coast Basin achieve needed emission reductions and can serve as a "push ahead" demonstration of Tier 4 locomotives to benefit the rest of the nation.

SCAQMD commented that it agrees with EPA's statement that the Tier 4 locomotive standards are feasible using today's technology, and stated that there is no need to delay implementation of these standards to await development of technology. The commenter noted that the Clean Air Act (CAA) (at section 213(b)) requires EPA to adopt standards which "take effect at the earliest possible date", thus the commenter stated that Tier 4 technology must be required as quickly as manufacturers can gear up to produce it. The commenter suggested that if such technology cannot be rapidly deployed on a nationwide basis, EPA should either adopt a regional rule, or at minimum, require manufacturers to phase-in Tier 4 technology as early as possible nationwide, by starting with some level of production no later than 2012, and increasing as rapidly as possible to full implementation. SCAQMD commented that much of the work on the remanufactured Tier 2 program will assist in developing engines to meet the proposed Tier 3 standards for new locomotive engines; which it believes that it follows that the implementation date for the proposed Tier 3 standards can and should be moved to the end of 2010.

The Oregon Environmental Council (OEC) requested that EPA finalize the rule by the end of 2007, and apply the regulations to all new and remanufactured engines. The commenter also encouraged full implementation of locomotive and marine diesel Tier 4 engine standards as soon as possible, but no later than 2015. OEC encouraged EPA to require all locomotive and marine engines to be updated with modern pollution control equipment when they are remanufactured, with implementation in 2008. OEC commented that it strongly encourages EPA to require interim standards (Tier 3) for trains with at least a 50% reduction in NOx emissions by 2012.

Environmental Defense and Environmental Defense, NRDC, et al. commented that they believe EPA should tighten up the NOx standards throughout the rule. The commenters noted that there is no Tier 3 NOx standard for locomotives, and urged EPA to require a Tier 3 NOx requirement by 2012 at the latest. (The commenters noted that the preamble indicated that reductions can be gained by applying EGR, and the CAA requires that EPA set standards that are technology-forcing.) Environmental Defense also urged EPA to require that Tier 4 PM and NOx requirements take effect as soon as possible, but no later than 2015. The commenters further stated that they support a schedule whereby all Tier 4 standards for locomotives (both line-haul and switcher) are implemented concurrently in 2015. The commenters noted that there is no Tier 3 NOx standard for locomotives, and suggested that EPA require, as soon as possible and no later than 2012, Tier 3 PM and NOx standards for locomotives. Environmental Defense, NRDC, et al. also commented that the health imperative for faster NOx reductions (discussed in detail in their comments and those of other commenters) shows that there is no reason to wait an additional 2 years for much needed NOx reductions.

The San Joaquin Valley Unified Air Pollution Control District commented that, relying on CARB's technical analysis, it believes that the Tier 4 NOx and PM standards should both be applied by 2015 and the Tier 3 NOx requirements should be applied by 2012 or earlier.

The City of Houston, Bureau of Air Quality Control (Houston BAQC) commented that it believes EPA should require compliance with the Tier 3 locomotive engine PM, NOx, and hydrocarbon (HC) emission standards by no later than 2010 because it is achievable. The commenter also requested that EPA require compliance with the Tier 4 PM, HC, and NOx emissions standards by no later than June 2012 because it is achievable.

A number of private citizens commented that all existing locomotive and marine engines should be required to begin installing the best currently-available pollution control equipment next year, and then this should be fully implemented as soon as possible; the commenters urged EPA to finalize the rule by the end of 2007. The commenters also urged EPA to fully implement the Tier 4 requirements for new locomotive and marine engines as quickly as possible, but no later than 2015. Additionally, some commenters also urged EPA to require locomotive engines to reduce NOx emissions by at least 50 percent for the interim standards (Tier 3) as soon as possible, and no later than 2012.

Do Not Set Accelerated or More Stringent Standards

The Association of American Railroads (AAR) noted that at the May 2007 public hearings, a number of entities suggested that the Tier 4 standards should be effective sooner. The commenter stated that the Tier 4 standards cannot be effective earlier because there is no basis for believing the research and testing that needs to be done to meet those standards will be completed before the proposed effective dates. The commenter noted that the Tier 4 standards will require aftertreatment devices, DPFs for PM control, and SCR systems for NOx control. The commenter stated that, generally new technology must be field-tested for at least two years before it can be implemented on a widespread basis; and that aftertreatment is such a major change that more than two years of field testing will likely be necessary.

AAR also commented that, with respect to the timing of the standards, the Tier 3 standards are technology forcing and sufficient time needs to be devoted to developing the technology and testing the technology in the field. The commenter noted the example that the builders expect to develop and utilize common rail fueling systems; if these systems are to be field tested well before the date by which they need to be applied to all new locomotives, the commenter believes that an effective date prior to 2012 simply will not be feasible.

EMD commented that it supports the timing of the Tier 4 locomotive standards in the 2015 to 2017 timeframe, but that is has concerns regarding the implications of the Tier 4 engine emissions standards and would prefer technical reviews of the feasibility of the standards well before they go into effect (discussed more in Chapter 10 of this Summary and Analysis document).

EMD commented that it supports the proposed Tier 4 standards, including the emissions limits and the compliance dates, noting, however, reservations on space and weight constraints and catalyst durability, and the consequent request for a technical review of catalyst deterioration and application feasibility.) The commenter urged EPA to resist any acceleration of the Tier 4 compliance dates as advocated by speakers at the May 10, 2007 public hearing. The commenter noted that this position is due to the widespread availability of ULSD on the railroads and the necessity for carrying out substantial field tests of aftertreatment technology in railroad service prior to full production. EMD also stressed that reliability is paramount in railroad service. The commenter noted that NOx and PM aftertreatment is a major new technology application for locomotives, and stated that an intensive program of development and reliability demonstration (including two to three years of in-house development and a field test of at least two years) will be necessary before it is placed into full production.

EMD also stated that it believes that a reduction in the Tier 3 NOx standard is feasible, but not advisable; the commenter recommended that neither the standard values nor the compliance date be changed.

GE commented that it believes the compliance deadline for the Tier 4 NOx provisions should not be accelerated and should allow adequate time to test and correct any problems revealed during the 2015-2017 introduction period.

GE also commented that the suggestion of re-optimizing existing Tier 2 NOx controls using injection timing retard is not a workable solution. The commenter noted that the reductions in NOx would be minimal and would come with an increase in PM, a fuel penalty of 10% to 20% (resulting in increased cost as well as increased greenhouse gas emissions), and an increased maintenance cost. The commenter stated that these factors weigh heavily against proceeding with an interim reduction, especially as the application of engineering and test resources toward an interim reduction would put the achievability of the Tier 4 NOx standard at even greater risk. GE also commented that, with regard to the requests for comment on the other impacts of applying EGR or injection timing retard technologies in the Tier 3 timeframe, this will again use significant engineering and facility resources (and divert attention from Tier 4) to achieve a lower Tier 3 NOx and has the potential for increased greenhouse gas emissions that will come with any significant reduction at the Tier 3 level. The commenter stated that Tier 3 would be a significant redesign that would only be effective for only 3 model years and will make it extremely difficult, if not impossible, to achieve the Tier 4 NOx reductions as of 2017.

GE argued that, although the lead time and stability provisions are not explicitly included in CAA Section 213(a)(5), if Congress had indicated EPA should issue a second round of locomotive standards, surely there would have been consideration of the need for stability between platform changes. Given the size of the market and the significant engineering challenges associated with locomotive controls, GE believes a longer time period than 3 years would have been included.

GE commented on the suggestion in the preamble that workload-based impediments to achieving a lower Tier 3 NOx limit might be able to be addressed by obtaining less than the proposed NOx reductions from remanufactured locomotives (i.e., Tier 0 and 1). GE stated that, based on its evaluation of this issue, there is little, if any, tradeoff to be gained in this regard; achieving slightly less reduction for Tier 0 and 1 would not require less effort. The commenter further stated that EPA has not proposed to lower the Tier 1 NOx limit so it would be difficult procedurally for EPA to issue a final rule that changes the proposed limit. With respect to Tier 0, GE noted that the types of changes it would make to achieve the revised NOx limit are largely based on the Tier 1 designs (so the additional engineering effort required to achieve the reductions does not compare with the resources required to achieve a Tier 3 reduction). GE noted that this why it will be able to make Tier 0 kits available relatively quickly.

GE noted that EPA requested input on whether an emissions averaging program between new Tier 3 locomotives and remanufactured Tier 0 locomotives might make a lower Tier 3 NOx level achievable in light of the cost and timing. The commenter stated that, to the extent that there are caps preventing application of credits to meet the Tier 3 standard for some percentage of the Tier 3 fleet, this option would not address concerns regarding engineering design, development, and implementation. The commenter also noted that, from an emissions impact perspective, EPA would be trading a reduction across the Tier 0 fleet with a reduction from the Tier 3 fleet - this analysis assumes that there will be an equal number of Tier 0 locomotives will be remanufactured over the time period that Tier 3 locomotives will be manufactured. The commenter stated that, given the large installed base, EPA would actually be increasing emissions throughout the country rather than reducing them with such a strategy.

GE commented that it believes that the proposed 5.5 g/bhp-hr line-haul Tier 3 NOx standard at is appropriate and should not be revised, in response to the request for comment on whether additional NOx reductions would be feasible and appropriate for Tier 3 locomotives in 2012 (72 FR 15970). The commenter noted that during the May 2007 public hearings, some questions were raised regarding the ability to achieve greater reductions at the Tier 3 level. GE commented that it agrees with EPA that reduced Tier 3 NOx levels are not achievable in light of lead time, cost, and energy factors and because any change will detrimentally affect manufacturers' ability to achieve the greatest reductions possible for Tier 4. The commenter further stated, as recognized by EPA, the transition to aftertreatment control for locomotives is a major technological leap that is uncertain at best. GE also noted that transitioning to aftertreatment will require all of its available engineering resources, including a significant testing effort; and implementing technologies to achieve an interim reduction for Tier 3 (such as EGR) would require a considerable development and redesign program for its locomotives.

The Engine Manufacturers Association (EMA) commented that regulatory lead time (the period of time between the adoption of emission control standards and their actual implementation date) is a critical requirement for any program to reduce emissions from engines, including the engines at issue in this rulemaking. The commenter noted that engine manufacturers need sufficient lead time to develop the advanced emission control systems necessary to meet the new emission standards, to integrate those advanced emission control systems into their new engine designs, to test prototype models of the new advanced low-emission engine systems, and to establish new manufacturing processes to produce the new integrated low-emission engine systems in an efficient and cost-effective manner. The commenter further noted that each of these steps in the development process to design and manufacture advanced low-emission engine products takes time, manpower, and money— all of which are limited resources. The commenter stated that, to the extent that insufficient lead time is provided, the emission standards at issue become inherently infeasible.

EMA commented that the NPRM proposed aggressive Tier 3 PM reductions of roughly 50% from the current Tier 2 standards. The commenter noted that the relevant Tier 2/Tier 3 reduction for nonroad engines represents only a 35% reduction. EMA commented that it believes that those proposed standards are too aggressive, since they are substantially lower than the Tier 2 and Tier 3 nonroad PM standards. The commenter urged EPA to consider a less aggressive step in PM reduction over the current locomotive standard. The commenter suggested that a 35% reduction over the current line-haul standard is a more reasonable reduction for the Tier 2/Tier 3 PM standards, and is more in line with the nonroad engine PM emission standards.

EMA noted that the CAA expressly recognizes the fundamental importance of regulatory lead time, and Section 202(a)(3)(c) mandates a 4-year lead time period for any emission standards applicable to heavy-duty vehicles or engines (42 U.S.C. §7521 (a)(3)(c)). The commenter noted that Section 213(b)—the statutory section pertaining to nonroad emission standards—mandates that the effective date for any such standards must be set "considering the lead time necessary to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance within such period, and energy and safety" (42 U.S.C. § 7547(b)). Thus, EMA commented, it typically seeks a minimum of four-years' lead time for any new engine emission standards. The commenter also noted that engine manufacturers' overall regulatory workload and the resulting engine development requirements are other factors that must be assessed in determining necessary lead time. The commenter stated that the overall regulatory workload facing engine manufacturers is staggering, and noted the following pending regulatory requirements: 2007 heavy-duty on-highway (HDOH) emission standards, 2010 HDOH emission standards, 2008 Nonroad Tier 3 engine emission standards, and 2011 to 2014 Nonroad Tier 4 engine emission standards.

Kirby Corporation commented that it believes that the effective date of the final rule needs to reflect sufficient time for the regulated community to become aware of their responsibilities.

In its public hearing testimony, Caterpillar Inc. commented that it believes the proposed timing of the NPRM is correct in that Tier 4 aftertreatment for the lower volume, more specific marine and locomotive applications is proposed only after the much higher volume on-highway and off-road diesel applications are developed and demonstrated in customer applications. Caterpillar noted that this introductory timing is critical to its business and must be maintained.

Caterpillar commented that the proposed order of introduction of the Tier 4 mainline locomotive standards (PM aftertreatment-forcing standards being implemented before the NOx aftertreatment-forcing standards) is backwards, based on the current state of development of aftertreatment systems for large engines. The commenter noted that, at time of remanufacture of the 2015 and 2016 product, Tier 4 NOx and PM would both need to be met. The commenter stated that the Tier 4 NOx standard for locomotives should be implemented before the Tier 4 PM standard based on emission control development maturity. The commenter also noted that PM aftertreatment of the efficiency required for locomotives is expected to lag substantially, whereas NOx aftertreatment in the form of SCR systems are available now for stationary engines in limited applications. Caterpillar also commented that it believes the two-year delay proposed between the Tier 4 PM and Tier 4 NOx implementation is inadequate from a product stability standpoint; the commenter requested that the Tier 4 PM and NOx introduction be designed in at the same time.

Letters:
American Lung Association (ALA) OAR-2003-0190-0509 (hearing)
American Lung Association of Metropolitan Chicago OAR-2003-0190-0518 (hearing)
Association of American Railroads (AAR) OAR-2003-0190-0566.1, 0479, 0510
California Air Resources Board (CARB) OAR-2003-0190-0596.1
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485, 0591.1
City of Houston (Texas) Bureau of Air Quality Control (BAQC) OAR-2003-0190-0561.1
Clean Air Task Force (CATF) OAR-2003-0190-0499
Clean Air Watch OAR-2003-0190-0500
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1
Environmental Defense OAR-2003-0190-0487, -0592.1
General Electric Transportation (GE) OAR-2003-0190-0590.1
Kirby Corporation OAR-2003-0190-0563.1
Missouri Department of Natural Resources (MDNR), Air Pollution Control Program OAR-2003-0190-0658
National Association of Clean Air Agencies (NACAA) OAR-2003-0190-0495, 0511, 0579.1
Natural Resources Defense Council (NRDC) OAR-2003-0190-0489
New Jersey Department of Environmental Protection, Air Quality Management (NJDEP) OAR-2003-0190-0562.2, 0562.3
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0512, 0551.1
Oregon Environmental Council OAR-2003-0190-0652
Ozone Transport Commission (OTC) OAR-2003-0190-0633.1
Private Citizens (*various*)
Puget Sound Clean Air Agency OAR-2003-0190-0484
San Joaquin Valley Air Pollution Control District OAR-2003-0190-0556.1
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0483, 0558.1
Wisconsin Department of Natural Resources, Bureau of Air Management (WDNR) OAR-2003-0190-0552

Our Response:

We have considered the many comments we received supporting our proposed locomotive standards and timing, or arguing for different standards/timing. Many state and local air quality agencies and environmental organizations argued that earlier implementation of Tier 3 and Tier 4 technologies is feasible and emphatically needed to address the nation's air quality problems. In the proposal we specifically requested comment on whether additional NOx emission reductions would be feasible and appropriate for Tier 3 locomotives in the 2012 timeframe, based on reoptimization of existing Tier 2 NOx control technologies, or the addition of new engine-based technologies such as EGR. Manufacturers submitted detailed technical comments indicating that achieving such reductions would result in a large fuel economy penalty, a major engine redesign that would hamper Tier 4 technology development, or both. Our own review of the technical options leads us to the same conclusion and we are therefore finalizing the Tier 3 emissions standards as proposed. We are also not accelerating the Tier 3 standards from the proposed 2012 start date as suggested by a number of commenters. We believe that the 4 years of lead time between now and the start of Tier 3 is needed for development, testing, and field prove-out of Tier 3 locomotives, and is also very important in spreading the engineering workload burden involved in smoothly implementing our entire slate of new standards (Tier 0+, Tier 1+, Tier 2+, Tier 3, and Tier 4, as well as the marine diesel standards). Calls for accelerating the remanufactured engine standards are addressed in section 3.1.1.1.

On the other hand, test data made available since the proposal and added to the public docket supports the argument for earlier implementation of Tier 4 NOx controls. This information is discussed in detail in preamble section III.C. Consequently, after considering this data and industry comments regarding feasibility, we have concluded that the progress made in the development of NOx aftertreatment technology has been such that this proposed allowance to defer NOx control is not consistent with our obligation under section 213(a)(5) of the Clean Air Act to set standards that "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, giving appropriate consideration to cost, lead time, noise, energy, and safety factors associated with the application of such technology."

As a result, we are dropping the proposed allowance for deferred NOx control in 2015-2016 Tier 4 line-haul locomotives, effectively advancing the Tier 4 NOx standard for these locomotives by two years. Besides meeting our obligation under the Clean Air Act, this change will simplify the certification and compliance program for all stakeholders by providing a single step for Tier 4 implementation. It will also provide substantial additional NOx reductions during years that are critical to the states for state implementation plan (SIP) development, thus helping to address what was arguably the most critical comment we received from state and local air agencies and environmental organizations.

Several commenters requested that we implement Tier 4 locomotive standards in 2013, or even earlier. We have considered the time required by the industry to complete the necessary research, design, development, and validation activities, and have concluded that 2015 is the appropriate date for the introduction of Tier 4 technologies on locomotives. See our analysis of comments in section 10.2.1 of this Summary and Analysis of Comments document, and Chapter 4 of the Regulatory Impact Analysis (RIA), for discussion of the individual steps leading up to 2015 implementation.

Commenters objected to the 3-year stability period (4 years for switchers) between the start dates for Tier 3 and Tier 4 standards, arguing that at least 4 years should be provided. We believe the 3-year period is appropriate because of the evolutionary nature of the Tier 3 requirements. We are not basing Tier 3 standards on a major technology step such as the addition of exhaust gas recirculation. In fact, we expect the base engine developments needed for Tier 3 will be entirely relevant to optimizing engine-out demands in preparation for Tier 4, and will benefit from the multiple years of field experience prior to the addition of aftertreatment on production locomotives. As a result, we do not think that the engineering workload and opportunity to recoup investment will be adversely impacted by our program implementation schedule. We note also that Clean Air Act Section 213 contains no minimum stability period for locomotive emission standards.

Regarding manufacturer comments on the relative stringency of Tier 2/Tier 3 PM standards for locomotives and nonroad engines, please see section 10.1.2.1.

Many commenters expressed a sense of urgency and asked EPA to finalize the rule by the end of 2007. Some expressed dismay at the lengthy process involved in getting from an Advance Notice of Proposed Rulemaking (ANPRM) in 2004 to a final rule. We believe the collaborative process pursued by EPA in this rulemaking, marked by many helpful discussions with all involved stakeholders, has resulted in a very comprehensive program, with near-term and long-term emission reductions that exceed those envisioned in the ANPRM. Our goal throughout this process has been to establish a high quality clean diesel program for locomotives and marine diesels as expeditiously as possible.

3.1.1.1 3.1.1.1 Remanufactured Locomotives

What Commenters Said:

NACAA recommended that the final rule include remanufacture standards for locomotives used for Class II and Class III railroads. The commenter urged EPA to require stringent remanufacture requirements for the existing fleet because locomotive engines have an extremely long operational life. The commenter also expressed support for NESCAUM’s recommendation to extend remanufacturing requirements to intercity passenger, commuter, and regional and local freight railroads; the commenter believes this change will help all regions of the country reduce in-use locomotive emissions.

NACAA recommended that the implementation dates for new engine and remanufacture standards be accelerated; the commenter expressed support for the proposed Tier 0 and Tier 1 remanufacture standards, but believes the Tier 2 remanufacture standard for PM should be implemented by the end of 2010, rather than the 2013 proposed date. The commenter noted that its technical experts have advised that the Tier 2 remanufacture standard for PM can be implemented by the end of 2010.

The New York State Department of Environmental Conservation noted that EPA proposed more stringent NOx emissions standards for remanufactured Tier 0 locomotive engines and more stringent PM emissions for Tiers 0, 1, and 2 when remanufactured. The commenter expressed support for EPA's efforts to require additional emissions reductions from existing locomotives; and expressed particular support for EPA's proposal to require the use of remanufacturing kits certified to the more stringent standards as soon as they are available (regarding the request for comment on relaxing the Tier 0 remanufacturing standards to allow manufacturers to concentrate resources on the Tier 3 standards). The commenter urged EPA to promulgate the Tier 0 remanufacturing standards as proposed. The commenter noted that Tier 0 covers roughly 20 years of locomotive production, many of which are still in use; and for the line-haul duty cycle, Tier 3 is not a great improvement over Tier 2, and will be quickly superseded by Tier 4.

The Puget Sound Clean Air Agency commented that it supports requiring the use of certified Tier 2 locomotive remanufacture systems on the same schedule as Tier 3, starting in 2012. The commenter stated that it also supports the requirement for remanufactured locomotive engines to meet emission reduction standards and to employ anti-idle technology.

The San Joaquin Valley Unified Air Pollution Control District noted that in California, diesel PM reductions from Tier 2 locomotives will be accelerated to year 2010 in accordance with California's emission reduction agreements with the railroads. The commenter stated that, considering the fact that the Tier 3 PM standard technology is required by year 2012, the Tier 2 PM remanufacturing standards should be in place much earlier than the proposed 2013 date.

SCAQMD commented that, due to the nature of the locomotive fleet in the South Coast Basin, which by 2010 will include more Tier 2 line-haul units than other areas, the proposed remanufacture standards will have little effect in accelerating air quality benefits. The commenter expressed support for the proposed Tier 0 and 1 remanufacture programs at the dates proposed, but urged that the Tier 2 remanufacture program be moved up to 2010 to ensure emission reductions needed for timely attainment. The commenter stated that much of the work on the Tier 2 remanufacture program will assist in developing engines to meet the proposed Tier 3 standards for new locomotive engines. The commenter urged EPA to adopt the proposal to advance the implementation dates for new and remanufactured engine standards and to tighten NOx emission standards for locomotive remanufactured engine programs. The commenter also urged EPA to adopt the SCAQMD-proposed standards and deadlines nationwide, or to at least phase them in beginning in Southern California and other areas with significant locomotive activities.

SCAQMD also urged EPA to adopt an optional NOx standard for remanufactured Tier 0 and Tier 1 engines set at the 6.0 g/bhp-hr level, and a more stringent NOx standard for the remanufactured Tier 2 program. The commenter noted that the Class I railroads are in the process of replacing a significant number of existing locomotives with new locomotives meeting the existing Tier 2 standard, thus these locomotives will be the dominant models operating in the future. The commenter stated that, without further NOx emission reductions, many areas soon to be designated nonattainment for the federal 24-hour PM2.5 ambient air quality standard or the new 8-hour ozone standard will not be able to demonstrate attainment by the applicable attainment date. SCAQMD stated that its analysis of the needed emission reductions to attain the federal 24-hour PM2.5 air quality standard by 2020 indicates that significantly greater emission reductions than what are called for to meet the 8-hour ozone air quality standard will be needed from all emission sources. Additionally, SCAQMD urged that consideration be given for a remanufactured Tier 3 program that would set the NOx emissions limit at the proposed Tier 4 standard of 1.3 g/bhp-hr in the 2015-2017 timeframe. The commenter noted that it has spent considerable resources and expertise to evaluate and demonstrate locomotive control technologies, which have led it to conclude that acceleration of the requirements in the proposed rule is feasible.

In its review of the Draft RIA, SCAQMD commented that it concurs with EPA that, for the proposed remanufacture programs, the focus will be on in-cylinder improvements which are existing, demonstrated techniques and technologies such as enhanced power assemblies to lower oil consumption and enhanced crankcase ventilation systems. The commenter further stated that aftertreatment control devices are not necessary to meet the proposed remanufacture standards, although such technologies will be needed to further reduce emissions. The commenter noted that there are about 60 locomotive configurations for which remanufacture kits must be developed to meet the proposed remanufactured standards. The commenter stated that remanufacture kits could be developed in such a manner to cover a group of locomotive configurations which would reduce the actual number of kits to be developed. SCAQMD noted that for more modern locomotives (Tiers 1 and 2) there may be a more limited number of configurations; thus reducing the need to design remanufacture kits for every individual configuration, and allowing locomotive manufacturers to devote more resources to developing new engines.

Houston BAQC suggested that EPA require compliance with the proposed PM emissions standard for rebuilt Tier 2 locomotive engines by no later than 2010 (rather than the proposed date of 2013) because it is achievable.

Environmental Defense, NRDC, et al. commented that they believe all locomotives and marine engines should be required to install modern pollution control equipment when they are brought into the shop to be rebuilt. The commenters further stated that this is feasible, cost effective, and will provide immediate benefits; the commenters further suggested that this requirement should begin being implemented in 2008 for all existing engines (as remanufacturing kits become available), and should be fully implemented on a mandatory basis by 2010 for locomotives and as soon as possible for marine engines.

Environmental Defense, NRDC, et al. commented that they strongly support the proposed requirements for remanufactured line-haul and switcher locomotive engines to meet the most stringent emission standard possible. The commenters stated that, even though staggering benefits will be achieved by 2030, cleaner air is needed now. The commenters believe that cleaning up locomotive engines when they are rebuilt is essential to protect human health and the environment- and suggested that EPA move forward with requiring all locomotive engines to install modern pollution control technology when they are rebuilt. The commenters stated that these engines have long lives, and repeated five to seven year remanufacturing intervals result in a slow turnover of dirty diesel engines.

CATF commented that it applauds EPA's proposal for tighter emissions standards for remanufactured locomotive engines. The commenter noted that locomotive engines have long lives and are designed to be remanufactured every four years or so during the engine's service life; the commenter also noted that the remanufacturing process produces engines that are like-new in terms of their emissions generation and control. The commenter urged EPA to continue to treat these remanufactured engines as new engines, and to require them to meet emissions standards reflecting best available control technology, as required by CAA Section 213 (a)(5).

NESCAUM encouraged EPA to accelerate the Tier 2 remanufacture requirements to no later than the end of 2010, rather than the proposed 2013 date. The commenter stated that, given the extremely long operational life of locomotive engines, remanufacture requirements are essential in order to achieve emission reductions from the existing fleet of locomotives; the commenter further expressed support for the Tier 0 and Tier 1 remanufacture standards as proposed. NESCAUM also commented that, according to its review of the Draft RIA, in the year 2020 the combined NOx-PM reduction cost-effectiveness of the locomotive remanufacturing standard is approximately $456 per ton. The commenter stated that this component of the regulation is extremely cost effective, compared to other strategies available to the Northeast States. NESCAUM commented that its region would especially benefit from expanding the remanufacture requirements to include commuter railroads and local and regional freight railroads.

Clean Air Watch commented that it believes that all train and marine engines should be required to install modern pollution control equipment when they are rebuilt. The commenter stated that this is feasible, cost effective and will provide immediate benefits. Further, the commenter recommended that this requirement be implemented in 2008 for all existing engines, and fully implemented as soon as possible.

CARB noted that the proposed Tier 0 and Tier 1 PM remanufacturing standards are power assembly (i.e., pistons, rings, cylinder liners) upgrades that are currently certified or available and need minor improvements. The Tier 2 PM remanufacturing upgrades (e.g., valve stem seals and closed crankcase ventilation system improvements) will take more effort, but the commenter noted that these upgrades are not full engine redesigns. CARB commented that Tier 2 PM remanufacturing certifications should be available by the end of 2010 and should be required for Tier 2 rebuilds starting in 2011, the earliest date any significant number of Tier 2 units are expected to undergo their initial remanufacture. The commenter further noted that the proposed Tier 3 PM-only standard is equivalent to the Tier 2 remanufacturing standard, and will not require a major engine redesign. The commenter stated that locomotive manufacturers have or can acquire the necessary resources to produce the Tier 0-3 remanufacturing upgrades by the end of 2010, and at the same time continue with new Tier 3 and 4 development. The commenter also noted that there are other companies (e.g., CSX, Wabtec, NREC) that can help fill the remanufacturing niche for the Tier 0, 1, and 2 remanufacturing standards.

NJDEP commented that it supports the Tier 2 locomotive rebuild requirements, but suggested that they be accelerated to no later than the end of 2010, instead of 2013.

A number of private citizens commented that they believe that, by 2008, all existing locomotives and marine engines should be required to install modern pollution control equipment when they are rebuilt. The commenters stated that this is feasible, cost-effective and will provide immediate benefits.

AAR commented that it believes the concept of accelerating the effective date of the new Tier 2 standards makes no sense since those standards are premised on Tier 3 technology and the need for an additional year beyond the Tier 3 effective date to apply that technology to Tier 2 engines. The commenter further noted that there is no expectation that the technology for Tier 3 standards will be available earlier. Thus, AAR suggested that §1033.150(a) be amended by: changing the title to "Early availability of Tier 0 and Tier 1 systems;" inserting "(1)" after "systems;" deleting the second sentence; redesignating former paragraphs (1) through (4) as (i) through (iv); and adding a new paragraph (2) "(2) Prior to certifying a remanufacture system under this subsection, EPA shall published a Federal Register notice of the application for certification and provide interested parties at least sixty days to comment on whether the proposed remanufacture system meets the requirements of paragraphs (a)(1)(I) through (a)(1)(iii)."

AAR noted it was proposed that Tier 2 locomotives be remanufactured to Tier 3 standards in 2013. Regarding the request for comment on whether this date should be 2012 (the effective date for Tier 3 standards), the commenter expressed support for applying the Tier 2 standards at a later date. The commenter noted that the assumption is that the same technology will be used for Tier 2 engines as Tier 3. However, the commenter noted, in the case of Tier 3 the issue is applying the technology to brand-new engines; with Tier 2, the technology would be applied to existing engines when rebuilt, an engineering feat the commenter believes is more complex. The commenter stated that the additional year will provide the locomotive manufacturers with needed time to use their limited resources to solve the retrofit issue.

AAR commented that there is a possibility that there will not be a remanufacturing system available for all of the older engine families. The commenter gave the example that the railroads question whether there will be a remanufacturing system for the over 2,000 EMD SD-2 locomotives in service on Class I railroads. The commenter noted that §1033.6l0(c) authorizes EPA to exempt locomotives owned by small railroads from the obligation to remanufacture locomotives to EPA standards if there is no remanufacturing system available for the locomotives. The commenter stated that there is no reason to exempt only small railroads in such an instance—all railroads should be entitled to an exemption if there is no remanufacturing system available.

GE responded to the request for comment on whether the early phase-in provision will disadvantage non-Original Equipment Manufacturer (OEM) remanufacturers who may be unable to develop and bring to market remanufacture kits prior to 2010 (72 FR 16000). GE commented that the proposal gives neither an advantage nor a disadvantage to non-OEMs. GE noted that in some cases it is both an OEM and a non-OEM provider, and its experience has been that the effort involved and time required to develop solutions for both OEM and non-OEM product offerings is roughly equivalent. Further, the commenter stated, the more relevant factors affecting development time are the complexity and magnitude of the changes involved.

GE commented that it believes that the proposed date of 2013 for Tier 2 kits meeting the new particulate standard is achievable and is the earliest possible date that can be supported. Regarding the request for comment on accelerating this date to 2012 to coincide with the Tier 3 compliance date based on the premise that substantial numbers of Tier 2 locomotives would be approaching the first scheduled remanufacture in 2012, GE commented that this premise is not correct and EPA should thus retain the 2013 date. The commenter noted that its estimation is that the total number of Tier 2 units that will be due for remanufacture in 2012 is less than 100; with this very small number of units, the commenter stated that it believes that the environmental benefit of compelling early introduction will be extremely small. GE further commented that, compared with the resources that would need to be applied to accelerate the Tier 2 kit availability, the benefit is not justified.

EMD commented that the Tier 2 remanufacture standards should be applied in 2013, and urged that the standards not be advanced to 2012—in response to the request for comments on this provision. The commenter stated that, while it is true that the applications will likely be similar, there is additional workload associated with designing it into the Tier 2 engine and carrying out the certification activity; the proposed schedule allows manufacturers to spread the workload and carry out the required development and certification in an orderly fashion. The commenter stated that accelerating the implementation of the Tier 2 remanufacture standards would place the ultimate goal of aftertreatment-forcing Tier 4 emissions levels in jeopardy.

Caterpillar, Inc. commented that it is very concerned that the requirements for Tier 2 locomotives produced from 2005 until 2012 mandate meeting a modified Tier 2 PM level of 0.1 g/bhp-hr; the commenter believes that this requirement effectively sets a standard with zero lead-time. The commenter stated that the customers for current design Tier 2 engines will expect immediate answers for how the new Tier 2 standards will be met when the engines are remanufactured after 2013. The commenter noted that the emissions standard proposed for Tier 2 engines at time of remanufacture is very stringent - a 50% reduction from the current standard, and is set at the same level as Tier 3 (which has time for significant engine changes to be incorporated) that may not be able to be retrofit into older engines. The commenter stated that the Tier 2 remanufacture standard needs to consider the lack of lead time associated with it and the potential impact on future sales of Tier 2 engines. Caterpillar commented that it believes that significant PM reduction can be provided for the Tier 2 product at remanufacture, but not at the reduction proposed by EPA. The commenter stated that the exact extent of the ability to retrofit PM reduction technology for the proposed Tier 3 standard will likely be limited. (For instance, Tier 2 is achieved with separate circuit aftercooling on some engines; retrofitting to air-to-air aftercooling would require substantial changes to the locomotive and engine). Caterpillar requested that EPA review these proposed standards and modify them so that appropriate levels and lead-times are included in the final regulation—the commenter believes that the PM reduction for Tier 2 engines at time of remanufacture should not exceed 35%.

MotivePower, Inc commented that it believes that requiring remanufactures to meet an interim standard only three months after a kit is available (§1033.150) will upset the locomotive remanufacture market significantly. The commenter noted that remanufacture contracts and work often span more than a year, and locomotive part lead-times are often longer than three months; thus, if a new standard becomes applicable during the course of a remanufacture contract, the remanufacturer could be left holding inventory that is no longer useful. The commenter also stated that remanufacture facilities must plan production and work much farther out than three months to operate efficiently, and many remanufacture contracts are written in stages of work. The commenter stated that an emissions standard that becomes effective within three months only causes expense to the remanufacturer or the railroad, depending on the terms of the remanufacture contract. MotivePower requested that EPA remove the interim standards from the regulation, or allow negotiated remanufacture contracts (which can span several years) to complete according to their originally negotiated terms.

Letters:
Association of American Railroads (AAR) OAR-2003-0190-0566.1
California Air Resources Board (CARB) OAR-2003-0190-0596.1, 0719
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485, 0591.1
City of Houston (Texas) Bureau of Air Quality Control (BAQC) OAR-2003-0190-0561.1
Clean Air Task Force (CATF) OAR-2003-0190-0499
Clean Air Watch OAR-2003-0190-0500
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502, 0594.1, 0662
Environmental Defense, et al. OAR-2003-0190-0487, 0592.1, 0610.1, 0610.2, 0610.3, 0638, 0610
General Electric Transportation (GE) OAR-2003-0190-0590.1
MotivePower, Inc. OAR-2003-0190-0613
National Association of Clean Air Agencies (NACAA) OAR-2003-0190-0495, 0579.1
New Jersey Department of Environmental Protection, Air Quality Management (NJDEP) OAR-2003-0190-0562.2, 0562.3
New York State Department of Environmental Conservation, Office of Air Resources OAR-2003-0190-0583.1
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0512, 0551.1
Private Citizens (*various*)
Puget Sound Clean Air Agency OAR-2003-0190-0484
San Joaquin Valley Air Pollution Control District OAR-2003-0190-0556.1
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0483, 0558.1

Our Response:

We have considered the comments calling for remanufactured engines to meet standards more stringent than those we proposed, even to the extent of applying advanced aftertreatment devices on pre-Tier 4 locomotives. Our evaluation of the available data reinforces our conclusion that these older locomotives lack the space or other needed design characteristics to add more advanced emission controls, such as additional cooling for intake air or catalytic aftertreatment devices. Our analysis shows that the comprehensive multi-faceted approach we are taking, with advanced technologies employed for longer term benefits and straightforward engine modifications pursued for large overall near-term benefits, to be the best way to structure the program. Manufacturer comments summarized in section 3.1.1—regarding their ability to handle the engineering workload involved in meeting multiple tiers of new standards, across a wide range of locomotive models—bolster our conviction that significantly more stringent Tier 0+ standards could compromise both our short-term and long-term objectives. We believe this approach is consistent with CAA section 213(a)(5).

A number of commenters called for acceleration of the Tier 2+ remanufactured engine standard, by as much as 3 years, but without providing evidence that this would be feasible. Our own analysis, discussed in RIA section 4.2 and in the rulemaking preamble section III.C, leads us to conclude that a year of lead time after the 2012 Tier 3 start date is appropriate to adapt Tier 3 technologies to the Tier 2+ locomotive remanufacture systems, and that 2012 is the appropriate start date for Tier 3. Our early introduction provision requiring use of any Tier 2+ systems certified before 2013 provides incentive for early introduction without risking disruption of the long-term program from overly aggressive mandatory short-term objectives. We also note that very early certification of Tier 2+ systems, either on a mandatory or voluntary basis, would not likely have a large environmental impact because the Tier 2 fleet is still quite new and not likely to be coming due for first remanufactures for some time yet.

We disagree with comments that the Tier 2+ PM standard of 0.10 g/bhp-hr cannot be met by 2013. As discussed in Chapter 4 of the RIA, our analysis shows that straightforward changes to current Tier 2 locomotive designs can achieve this standard by 2013, and perhaps sooner. Our new program lays out the long-term regulatory framework under which any new Tier 2 products must be designed, adding a substantial degree of certainty to the design process for them.

We do not agree with the comment that our setting a 2013 remanufacturing standard for Tier 2 locomotives has the effect of creating a zero lead time requirement. As our analysis shows, the 2013 standard is feasible, and we do not think railroads will avoid buying a new Tier 2 product because of a manufacturer stating or implying that it may not be able to meet the more stringent standard by 2013. We also do not agree that requiring remanufacturers to meet a new standard three months after a kit is available will upset the locomotive remanufacture market because of long-term contracts, parts inventories, and the like. We do not expect the new standards to greatly change the remanufacturing process so as to increase locomotive downtime or produce other disruptive effects. Furthermore, our final regulations provide substantial flexibility for the railroads in meeting the new standards during the early implementation period, and parts inventories and contract obligations can be readily factored into their remanufacture plans.

Regarding AAR's comment that no certified Tier 2 remanufacture systems will be made available before 2013, and that EPA ought to therefore drop the early availability requirement for them, we believe it is prudent to retain this requirement. Emission control technology progress has at times exceeded our initial expectations in the past, especially where several years of lead time are involved or where there is a business incentive for early development, both of which are relevant here. If in the end no certified system is developed before 2013, no action will be required under this provision and any uncertainty effect or other burden it puts on the railroads will be minor.

We do not agree with AAR's comment that EPA should exempt large as well as small railroads from requirements for locomotive models without certified remanufacture systems. First, we note that, for the vast majority (and perhaps even all) of the Tier 0 locomotives, these standards are feasible using the straightforward technologies described in RIA Chapter 4. We believe that the very few locomotive models for which certified systems may not be available in time are primarily very old models that are few in number, and are more likely to exist in the non-Class I railroad fleets. We do not believe it is appropriate to compromise the environmental benefits of the program by setting standards based on a small number of older outlying engines. Second, given a mandatory EPA requirement, experience has shown that the larger railroads can exert substantial leverage in the industry to help ensure timely availability of certified products. Our exempting the entire rail industry could create a self-fulfilling prophecy whereby few if any certified systems are made available. Finally, we note that a similar situation existed for the original Tier 0 standard-setting, and did not result in significant operational disruptions for the railroads: "Both the manufacturers and the railroads have agreed with EPA that these (original Tier 0) standards are feasible, but that they will require extensive use of averaging, and may lead to a few locomotive models being removed from service." (from the Regulatory Support Document for the 1998 locomotives final rule, April 1998, p.66). Although we do not believe that extensive use of averaging will be needed for Tier 0+ compliance, credit use remains a viable option in dealing with these older locomotives, especially for large railroads with diverse fleets. When these locomotives are approaching needed remanufacture, we believe it is preferable for Class I railroads to decide among available environmentally-beneficial options rather than allowing continued operation, and potentially repeated remanufacture, as high-emitters on large railroad systems.

See section 11.1.2 of this Summary and Analysis of Comments document for a response to comments about greenhouse gas, fuel economy, and energy impacts of these regulations. See section 7.1 for a response to comments about extending the remanufactured locomotive standards to smaller railroads.

3.1.1.2 Switch Locomotives and Switch Cycle

What Commenters Said:

CARB commented that it believes that switch locomotive standards should be set at levels at least as stringent as proposed, but the commenter recommended alignment of the implementation dates with those for line-haul locomotives. The commenter noted that significant changes have occurred in the rail industry since the previous 1998 rulemaking that impact switch locomotives-- today's line-haul locomotives (e.g., 4,000 hp versus 2,000 hp) are too large for practical use in switching service. The commenter also noted that sales of new conventional switch locomotives in the U.S. are negligible and have been so for many years. The commenter stated that smaller builders have entered the market to sell refurbished locomotives using non-road engines—the genset locomotive, which uses one to three newly built nonroad diesel engines and are certified under 40 CFR Part 92 emission testing requirements. The commenter noted that current genset locomotives already exceed the proposed Tier 3 switch locomotive standards, and with aftertreatment are anticipated to meet Tier 4 levels before 2015.

Environmental Defense, NRDC, et al. commented that switcher engines tend to be old and many are not subject to any emission standards at all. The commenters also noted that these engines "can be maintained almost indefinitely," and are often located at rail yards in or near urban neighborhoods creating pollution hot spots. The commenters stated that they fully support the proposed Tier 3 and Tier 4 for newly built switch engines. The commenters also restated their support for requiring remanufactured switch engines to meet the most stringent emissions standards possible.

AAR commented that, while it believes that earlier effective dates for Tier 4 locomotives are infeasible, it does not object to EPA's proposal of an earlier Tier 4 NOx effective date for switch locomotives than for line-haul locomotives. The commenter noted that this earlier date is premised on the use of small nonroad engines for brand-new switch locomotives. The commenter further stated that it has no objection to the Tier 3 locomotive switch standards becoming effective earlier than the line-haul standards and requiring greater reductions.

EMA noted that in §1033.101 the proposed Tier 2 PM standards for rebuilt engines and the proposed Tier 3 PM standards for new switcher applications are at the same level; a 50% reduction when compared to the current Tier 2 switcher standard. The commenter noted that the proposed Tier 2 PM rebuild standards and the Tier 3 PM standards for new switcher applications are not in harmony with the nonroad Tier 2 and Tier 3 PM standards, and so will require new engine development programs outside of the scope of what is in place for nonroad engines. The commenter recommended that, to avoid the unacceptable workload burden that would result for engine manufacturers and to attain proper alignment with the nonroad engine standards, the Tier 2 switcher PM rebuild standard should be set at 0.15 g/hp-hr (0.20 g/kW-hr), and the Tier 3 new switcher PM standard should be set at 0.15 g/hp-hr (0.20 g/kW-hr). The commenter stated that, unless there is this type of harmonization of the PM standards, the otherwise slight differences in the two sets of PM standards will drive separate technologies or engine families. EMA stated that the impact on the proposed PM standards from its recommended and necessary harmonization is small, and would still be a greater percent reduction in PM emissions than what has been proposed for the line-haul application.

EMA commented that it believes the proposed 2015 effective date for the Tier 4 switcher locomotive standard will cause additional difficulties for engine manufacturers due to the coinciding implementation of Tier 4 standards for nonroad engines greater than 750 hp. The commenter stated that manufacturers will face serious resource constraints for introducing product on time to meet those overlapping standards; also, the application development is ordinarily expected to flow from nonroad engines to locomotive switcher engines. However, the commenter stated, if EPA makes EMA's other suggested changes for switcher locomotives – including the increase in the Tier 4 PM standard – an aggressive schedule could be feasible. If that is the case, the commenter suggested that the implementation date for Tier 4 switchers should be extended modestly to October 2015 to allow some time to phase-in the locomotive work after the required nonroad application work. The commenter further stated that a longer extension will be required if requested changes to the switcher standards are not implemented.

EMA and Caterpillar noted that the proposed Tier 4 emission standards for switcher locomotives are at the same numerical levels as those for line-haul locomotives. However, the commenters stated, the switcher cycle is much more difficult than other test cycles, and thus adjustments should be made to the numerical emission limits for switchers. The commenters stated that they believe that selecting the same numerical PM limits for the switcher cycle as for line-haul results in an emissions standard that is much more stringent for switcher locomotives due to the much higher cycle weighting of lower loads for the switcher cycle. The commenters further noted that the specific emissions (on a g/bhp-hr basis) for an engine tested on the switcher cycle are also much higher than on the C1 cycle. EMA and Caterpillar also commented that the possible aftertreatment technologies for switcher applications are temperature sensitive, and aftertreatment systems generally work better at high exhaust temperatures than at low temperatures. As the switcher cycle has heavy weighting at low loads, and exhaust temperature increases with increasing load, this cycle will have more limited aftertreatment effectiveness. The commenters stated that they believe the net result is that the Tier 4 switcher standards need to be revisited taking into account the more difficult nature of the switcher cycle. The commenters also noted that the higher weightings at low load for the switcher cycle make the cycle numbers higher for a given capability; particularly, that large portions of idle for switchers make the cycle more difficult (59.8% for switcher as compared with 38% for line-haul) especially with respect to the emission standards for PM and hydrocarbons.

EMA and Caterpillar commented that the Tier 4 switcher standards are based on the introduction of nonroad emission control technologies. The commenters noted that nonroad applications and cycles have even lower time at idle than line-haul locomotives; and the switcher standards need to take this difference into account as well. The commenters cited data provided to EPA by an EMA member company which compared the PM emissions on the locomotive switcher cycle to the emissions on the C1 nonroad cycle. This data showed that the PM emission standard must be approximately 2 times the nonroad standard to be comparable in terms of overall stringency; taking into account the fact that the nonroad PM emission standard for gensets of 750 hp and above is 0.02 g/bhp-hr and 0.03 g/bhp-hr for non-gensets, the minimum PM standard for switcher locomotives should be set at approximately 0.06 g/bhp-hr. The data showed that hydrocarbon emissions are similarly affected by the test cycle, and should be no lower than 2.2 times the nonroad standards (2.2 x 0.14 = 0.3 g/bhp-hr). Lastly, the data indicated that for CO emissions, a level of not lower than 1.6 times the nonroad standard (1.6 x 2.6 = 4.2 g/bhp-hr) is required for similar stringency.

EMA and Caterpillar commented that the switcher application is subject to market forces driving lower emissions, and noted that there will be a market for switcher engines cleaner than EPA's standard in certain areas of the country due to various incentive programs. The commenters stated that they believe this will drive the development of switchers with emissions lower than the standard, if lower emissions are indeed feasible. The commenters warned that the introduction of low-emission switchers into the market can be hampered by standards that are overly stringent due to delays in developing a compliant product, the uncertainties of meeting the standard, and the structure of many incentive programs. The commenters also stated that very stringent standards for new switchers also can have the unintended effect of discouraging the purchase of new switchers and continuing to use the older and higher emitting locomotives.

Caterpillar, Inc. commented that it supports eliminating the switcher cycle requirement from line-haul and the line-haul requirement for switchers for the proposed standards.

GE commented that because 6-axle line-haul locomotives are not being used in switcher service any longer, EPA should eliminate the requirement for Tier 0, Tier 1, Tier 2, and Tier 3 6-axle 4000+ hp locomotives to meet and prove compliance with switcher cycle standards. GE stated that this would reduce the costs of the rule with virtually no impact on emissions levels (and would allow GE to devote all of its resources toward achieving the technology-forcing line-haul standards). The commenter further stated that there is no reason to believe that adding the switch standard to line-haul units provides an emissions benefit. The commenter noted that under the proposal the Tier 2 remanufacture and Tier 3 freshly manufactured particulate standards are identical, and these line-haul locomotives are required to meet the switch locomotive standards (§1033.101, Tables 1 and 2). The commenter noted that this is also continued under the part 92 rules requiring line-haul locomotives to meet the particulate standard for switch locomotives as well (§1033.101, Table 1, fn. A, b). GE commented that, for the part 92 rules it made some sense to apply dual emissions standards and duty cycles because of the historical railroad practice of moving locomotives from line-haul to switch service as they aged. However, the commenter noted, due to changes in the locomotive industry this practice does not represent current practice. The commenter stated that the need for dual standards no long exists, and recommended that the requirement to meet both standards be eliminated. The commenter offered the example that 6-axle, 4000+ hp locomotives are not being transitioned to switch service as they age due to size, weight, and maneuverability limitations; and as a result, the requirement for these units to meet the switch standards is no longer meaningful.

GE commented that this change in industry practice makes sense because 6-axle 4000+ hp locomotives are simply not suited to switch service. The commenter noted that starting in the early to mid-1980s line-haul locomotive design transitioned from 4-axle 3000 hp to 6-axle 4000+ hp designs, with an attendant increase in weight from 300,000 to over 400,000 lbs. The commenter further noted that additional axles and weight make these units unsuitable for switch service as they cannot easily negotiate the tight turns typical of most switchyards; and the larger locomotives are not economical to operate in switch service from a fuel consumption and maintenance standpoint when compared to the lighter, lower horsepower (hp) 4-axle locomotives commonly used in switch service today. The commenter stated that, even in yards where tight turns may not be a concern, railroads are still opting for lighter, 4-axle locomotives for switch service and, more recently, are using modern hybrid switch and/or switcher genset locomotives to replace older, 4-axle locomotives as they reach the end of their service lives.

EMD commented that it believes that the switch cycle standard is superfluous for line-haul locomotives and should be abandoned. The commenter also expressed this same opinion for line-haul cycle applicability to switch locomotives. EMD noted that the proposed rule requires Tier 0 through Tier 2 line-haul locomotives to meet switch standards of the same Tier, and requires Tier 3 line-haul locomotives to meet Tier 2 switch standards. EMD stated that it understands and supports EPA's reason for imposing this requirement (to control emissions in rail yards, which often are located in urban areas). Further, EMD stated that it agrees with EPA's belief that line-haul locomotive operation in the vicinity of rail yards can in many cases be more accurately represented by the switch cycle than by the line-haul cycle, and that it supports EPA's environmental justice considerations. EMD commented that it believes the line-haul standards already perform the required functions. The commenter stated that the switch cycle emissions results correlate well with the line-haul cycle results, so that once the line-haul results are known, the switch cycle results can be predicted with a high degree of certainty, and a locomotive that has low emissions on the line-haul cycle will also have low emissions on the switch cycle. (The commenter noted the calculation scheme that subjects the same set of data to two sets of weighting factors to come up with two composite results.)

EMD noted data that it assembled from various testing of 41 Tiers 0-2 and no-tier locomotives show excellent linear correlation between line-haul and switch cycle results—the correlation for NOx is over 90%, and the correlation for PM is over 93% (the NOx emissions are plotted in Figure 1, OAR-2003-0190- 0594.2; PM emissions are plotted in Figure 2, OAR-2003-0190- 0594.3). The commenter stated that, given the high correlation between line-haul and switch cycle results, the requirement for line-haul locomotives to meet the switch cycle standards is superfluous, and serves no purpose other than giving manufacturers another set of standards to meet, and another set of calculations to perform. For EPA and for stakeholders in the development of the rule, it creates the problem of assuring that both sets of standards lead to equivalent emissions reductions. This latter did not happen on the 1998 rule; particularly for Tier 0, the switch cycle standards were notably less stringent than the line-haul standards. (EMD also commented that the same argument pertains in reverse; the commenter noted that because the line-haul and switch cycle results correlate so well, it is also superfluous to require Tier 1 and Tier 2 switch locomotives to meet the line-haul standards of the same Tier, as currently required in Part 92 and proposed to continue in Part 1033.)

EMD noted that line-haul locomotives produced today are unsuited for switcher service. The commenter stated that the demand for line-haul locomotives today is for units in the 4000 to 4500 horsepower range, however the practical upper limit for switch locomotives is about 3000 horsepower (further, freshly manufactured switch locomotives being introduced today are in the 1500 to 2000 horsepower range). The commenter stated that if line-haul locomotives are above the power range suited for switching service, and the need to control their emissions in and around rail yards is satisfied by the line-haul standards, it makes little sense to subject them to switch locomotive standards. EMD urged EPA to remove the requirements for line-haul locomotives to meet switch locomotive standards and for switch locomotives to meet line-haul locomotive standards; and to allow each set of standards to be applicable only to the types of locomotives that meet the respective definitions of line-haul and switch locomotives.

The commenter noted that EPA based its Tier 3 and Tier 4 standards for switch locomotives upon the use of nonroad engine technology. The commenter further stated that EPA has observed that builders smaller than the traditional locomotive OEM's have entered the switch locomotive market, purveying freshly manufactured or remanufactured locomotives powered by one to three newly built diesel engines originally designed for the nonroad engine market. The commenter noted that the so-called "genset switcher" technology is very new on the market (with the first example having been delivered only in September of 2005) and it is not yet known how these locomotives will fare over the long term. The commenter stated that basing the entire Tier 3 and Tier 4 switcher program on this technology is faulty because this technology may ultimately fail. (The commenter offered as an example the fact that the entire fleet of 59 Railpower Green Goat® hybrid switch locomotives was, at the time of comment submission, out of service due to battery fires). EMD commented that the history of North American railroading is full of examples of innovations that seemed like good ideas at the time, but ultimately failed; the commenter stated that, by tying the proposed switch locomotive standards to a very new technology, EPA is risking a similar failure of this rule.

EMD commented that setting low switch standards based upon the capabilities of nonroad engines potentially denies railroads the durability advantages of medium-speed engines. The commenter stated that medium-speed engines in switch locomotives benefit from the features designed into similar engines built for the much more demanding line-haul locomotive service, and as a result, a medium-speed switch locomotive engine can operate for long periods of time with minimal maintenance, and infrequent rebuilding requirements. The commenter noted that it is unlikely that the same could be said for engines derived from nonroad technology. The commenter stated that EPA implicitly conceded this point in §1033.101(g)(3), in which manufacturers and remanufacturers of non-locomotive-specific engines are allowed to negotiate a shorter useful life with EPA. EMD commented that, though EPA noted in the Preamble that "it is not EPA's intent to discourage the development and sale of traditional medium-speed engine switch locomotives," the proposed standards will have precisely that effect. The commenter stated that EPA's conclusion that "the proposed Tier 3 and 4 standards . . . will be feasible for switchers using medium-speed engines as well as higher-speed nonroad engines," meeting the switch cycle standard will require lower emissions in the test modes than meeting the line-haul standard will. The commenter noted that this means that a medium-speed engine for a switch locomotive will have to be a separate engineering effort from an engine for a line-haul locomotive; and as the switch locomotive market is only a fraction of the line-haul locomotive market, will make it difficult for manufacturers of medium-speed engines to justify that effort. The commenter stated that there are several potential consequences to this which could reduce competition in the switch locomotive market: the traditional locomotive manufacturers could finally abandon the switch locomotive market, or medium-speed-engined switchers could become more expensive.

EMD commented that it believes that EPA seems to be accepting this risk to its program and to the railroad industry for relatively small emissions benefits. EMD commented that data presented in Figures 1 and 2 of its comments (OAR-2003-0190-0594.2 and OAR-2003-0190-0594.3), in support of its assertion that line-haul locomotives should not be subjected to switch cycle standards and vice versa, indicates that at the Tier 2 level, switch cycle particulate emissions are only about 20% higher than line-haul cycle emissions for the same data set, and switch cycle NOx emissions are only marginally higher than they are on the line-haul cycle. The commenter noted that at the Tier 3 level, switch cycle particulate emissions are about 50% higher than line-haul cycle emissions, but at a much lower level, because the Tier 3 particulate standards are cut in half from Tier 2. EMD recommended that the switch locomotive standards for Tiers 3 and 4 be set in the same way as the Part 92 switch locomotive standards were set, to be marginally higher than the line-haul cycle standards to reflect the higher duty cycle emissions to be expected from a lighter cycle load factor. (The commenter also offered that it would gladly provide whatever data EPA might need to aid in setting such standards.)

Letters:
Association of American Railroads (AAR) OAR-2003-0190-0566.1, 0479, 0510
California Air Resources Board (CARB) OAR-2003-0190-0596.1, 0719
Caterpillar Inc. OAR-2003-0190-0485, 0498, 0580.1, 0591.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502
Engine Manufacturers Association (EMA) OAR-2003-0190-0545, 0503, 0575.1
Environmental Defense, NRDC, et al. (0592.1)
General Electric Transportation (GE) OAR-2003-0190-0590.1

Our Response:

Regarding the comments from CARB, we have aligned the Tier 4 attainment dates for line-haul and switch locomotives (to 2015), but believe that switch locomotives can and should be certified to Tier 3 standards in 2011, while line-haul locomotives can and should start Tier 3 in 2012, as proposed. This is because the nonroad engine-based approach to switcher design, already established in the market and greatly facilitated by our streamlined program in new part 1033, will provide engines able to meet these standards across a wide spectrum of engine sizes starting in 2011. We set the switch locomotives standards so as not to rule out use of medium-speed diesel engines used in the past in switchers and today in line-haul locomotives. However, because nonroad engines are the platform-of-choice for newly-built switchers today, and nonroad engines able to meet Tier 3 standards will be available in 2011, we believe that this should be the date to start Tier 3 for switchers, rather than a date derived from line-haul locomotive developments. We feel that the need to have a range of nonroad engines available to switch locomotive designers argues against even earlier start dates for Tier 3 and Tier 4 switch locomotive standards, even though some low-emission nonroad engines may be available earlier on a limited basis.

Commenters took issue with EPA's setting of Tier 3 and Tier 4 start dates so closely aligned with standards dates in the nonroad sector. Some took further issue with EPA's assumption of long-term success for switch locomotives using nonroad engines in the first place. In response, we make a number of observations.

First, though some new switcher products have experienced problems in the field, there are also successful product introductions today that are based on the nonroad engine approach. Given that this approach has already been shown to be successful, there is no reason to believe such an approach will be infeasible or unsuitable in the future. Second, although we wish this program to have a variety of nonroad engine products available in any year in order to maximize its success, there really is a continuum of low-emission nonroad engines coming available over the years, owing to the way the nonroad program and the engine market are structured. There really is no point in time before which there is nothing or very little available for use in switchers and after which a plethora of choices exists. Third, although we think state and local incentives to turn over the switcher fleet will drive the program to the cleanest engines on the market, our streamlined approach does not force that outcome in every case; the use of any certified new nonroad engine is a gain for the environment, because of the vast difference between even the least clean of those engines and the old switchers being replaced. Fourth, new switcher sales have been low for many years owing to the practice of retiring and rebuilding older locomotives for this duty and, though our program aims to reverse this state of affairs, the railroads could likely weather a continued lull in sales should startup problems arise in the field.

Fifth, although we have based the switcher standards on the nonroad engine opportunity, we also believe that medium-speed engines can be developed to meet these standards in or near the same timeframe. The Tier 4 switcher standards take effect in 2015, the same year as for Tier 4 line-haul locomotives. With the diminished significance of the idle notch weightings caused by our idle control provisions, the switch cycle does not differ from the line-haul cycle so significantly that the same Tier 4 technologies cannot be optimized for use in both applications. Should market demand for newly-built medium-speed switchers justify the investment by the builders, there is no technological barrier to developing such Tier 4 switchers. Likewise, the Tier 3 switcher standards are comparable to Tier 3 line-haul standards, and take effect only one year earlier. We are confident that medium-speed Tier 3 switchers could be developed in time should the market call for this. This confidence is based in part on the substantial flexibility for both NOx and PM control afforded by injection timing optimization (a relatively easy to accomplish design change), considering that fuel economy in switcher service is nowhere near as critical as in freight hauling. This opportunity for engine-out switcher emissions optimization also factors into Tier 4 aftertreatment efficiency demands across the cycle notches.

We do not agree with comments calling for more exact harmonization of nonroad and switch locomotive standards, and in particular arguing that large nonroad engines designed to Part 1039 standards will need major redesign to meet the Tier 3 switch locomotive standards. First, we note that the streamlined certification program provides an opportunity to use Part 1039 engines in switchers without Part 1033 testing or certification. Second, should locomotive builders choose to certify to Part 1033 because of customer demands, funding requirements, desire for credit generation, or other reasons, a selection of large low-emitting nonroad engines will be available starting in 2011, the first year for the Part 1033 Tier 3 switcher standards of 0.10 g/bhp-hr PM and 5.0 g/bhp-hr NOx. Some of these engines will, on the nonroad cycle, be emitting at levels as low as 0.01 g/bhp-hr PM and 2.5 g/bhp-hr NOx, or lower. We agree that the numerical levels cannot be simply compared owing to test cycle differences, but we do not agree that these engines will need major redesign to achieve the Part 1033 levels.

We agree with comments that the current switcher fleet includes many old locomotives not subject to EPA standards. We have structured our program to encourage and facilitate the replacement of these units with new low-emitting units. We also note that the Clean Air Act allows the State of California to regulate these pre-Tier 0 locomotives, with authorization from EPA, and that other states may then adopt California's standards.

With regard to subjecting line-haul locomotives to switch cycle standards, our original reasons for setting switch cycle standards for line-haul locomotives in 1998 were to help ensure robust control in use and in recognition of the fact that many line haul locomotives have in the past been used for switcher service later in life. Due to increases in the size of new line-haul locomotives over the years, the latter is of less concern today, as these larger locomotives are not suitable for yard switching. However, the first reason, added robustness, remains applicable for pre-Tier 4 locomotives. We expect that the aftertreatment technologies used in Tier 4 will provide effective control over a broad range of operation, thus lessening the need for a switch cycle to ensure robust control.

Commenters arguing for dropping the switch cycle for line-haul locomotives provided two basic arguments: Today's line-haul locomotives are too large for switcher service, and switch cycle emissions results directly correlate to line-haul cycle results and so are superfluous. We agree with the first reason, as discussed above. However, we continue to believe that certification test cycle robustness, even for line-haul locomotives operating in line-haul duty, is important for Tier 3 and earlier. The second reason, correlation of emissions on the two cycles does not get at the core reason for having robust requirements-- to deal with the possibility that some design approaches could perform well in testing but not in use. The switch cycle better evaluates a locomotive while operating in urban areas, near or in rail yards, and in other places not uncommon in typical railroad operations. Without a switch cycle requirement, a locomotive could be designed with high emissions in notches common to this type of operation but not highly weighted on the line-haul cycle. The fact of good correlation between cycle results for locomotives today, designed as they are for good control on both cycles, does not mean that future designs would necessarily have the same result. Furthermore, we do not believe that the calculations needed to verify compliance on both cycles is overly burdensome.

3.1.2 Idle Controls

3.1.2.1 General Support for Idle Reduction Requirements

What Commenters Said:

The Oregon Department of Environmental Quality (ODEQ) commented that it is pleased EPA is seeking to eliminate emissions from unnecessary locomotive idling.

Kim Hotstart Manufacturing Company (Kim Hotstart) commented that it supports EPA's efforts to reduce idling. The commenter noted that shutting down an idling locomotive reduces fuel consumption, oil consumption, emissions, noise, engine wear, and wet-stacking.

NJDEP commented that it supports the proposed automatic engine stop/start (AESS) idling requirements for all new and remanufactured locomotives. The commenter noted that most locomotives idle about 50% of the time, which is a large and unnecessary source of diesel emissions. The commenter stated that AESS systems automatically control the amount of time that a locomotive idles, and are a cost-effective and reasonable approach for addressing a serious concern in New Jersey (the commenter noted that prolonged locomotive idling has been a real concern for many years in New Jersey, due to the dense population and the proximity of switch-yards to urban areas).

NJDEP commented that there are numerous areas in the state where locomotive idling occurs for extended periods of time and sometimes all day. The commenter noted that preliminary modeling of one locomotive area indicates that the 8 and 24 hour particulate matter standards may be exceeded. Due to the large number of citizen concerns raised about locomotive idling in New Jersey, NJDEP noted that it has been proactive in encouraging voluntary industry efforts to install locomotive idling reduction technologies. Unfortunately, NJDEP has met with little, if any, cooperation from private and state-funded rail operators, and believes that without EPA's support, this problem will continue. NJDEP commented that it is clear that current idling technologies are cost-effective and unlike tailpipe emission controls, the AESS, an auxiliary power unit (APU) or similar system, result in direct financial benefits to the rail operators. The commenter noted that payback periods for these technologies can range from 6 months to 3 years depending on the cost of fuel, the cost of the system, and the period of use; and as the price of fuel increases, these payback times will decrease. The commenter also noted that the cost decreases substantially if the idling controls are designed into the original locomotive. For these reasons, NJDEP strongly recommends that cost-effective solutions like idling reduction technology be mandated by EPA.

NACAA and NESCAUM commented that they support the proposal to require AESS idle control systems on all newly built Tier 3 and Tier 4 locomotives, as well as on all existing locomotives subject to remanufactured engine standards. NACAA noted that this requirement will help reduce public exposure to air pollution around railroad yards. NESCAUM further commented that emissions from locomotive engine idling pose significant health risks, particularly for persons living near railroad switch yards; and AESS systems will significantly help reduce public exposure to harmful air pollutants and at the same time reduce fuel consumption.

Environmental Defense, NRDC, et al. commented that locomotives spend a surprising amount of time idling—switcher engines spend almost 60% of their time idling, and long-haul engines idle approximately one-third of the time—spewing unnecessary amounts of pollution into the air and wasting fuel. The commenters further noted that engine idling is one of the top contributing factors to high locomotive emissions. The commenters stated that they are in full support of the proposal to require at least an AESS system on all new Tier 3 and Tier 4, as it would reduce harmful emissions and realize significant reductions in fuel consumption.

ZTR Control Systems (ZTR) commented that it supports the mandatory application of Idle Reduction Technologies to locomotives as an economical, proven, measurable, and effective method of reducing emissions. The commenter noted that it has been supplying the rail industry with AESS systems since 1988.

ZTR commented that there have been concerns expressed by some with the application of an AESS on a locomotive. The commenter noted one concern is with the reduced life of starter motors; however, locomotives built by EMD prior to the Dash 2 series of locomotives (pre 1970s) as well as all GE locomotives have either generator or auxiliary generator starting systems. These locomotives utilize existing generators as motors during the starting process and are unaffected by any concerns regarding starting motor failures. ZTR commented that in the earliest locomotives with starter motors, a significant factor contributing to failure was a phenomenon known as butt engagement—where the starter motor pinion does not mesh with the engine starter ring gear, resulting in a short circuit which, if left unchecked, could burn out the starter motor. ZTR noted that there are simple but effective upgrades available that can eliminate the potential for this occurrence. With regard to concerns about wear due to use, the commenter stated that an automated start by any AESS system is kinder to the locomotive and especially to the starter motors than a manual start. The commenter noted that this is because the locomotive engine is shut down at the earliest opportunity, thus ensuring that there are no carbon deposits built up in the combustion cylinder chambers after extensive idling. Further, when the engine is restarted automatically it is always warm (a significant advantage when restarting a diesel engine), and the batteries will always be above minimum voltage requirements. Lastly, when an engine is automatically restarted, the process adheres to strict OEM guidelines, for example a maximum 20 seconds of crank time with a minimum of 2 minutes between restart attempts to allow the start motor sufficient time to cool down. The commenter stated that an advanced AESS will have incorporated vital features such as governor assist pumps and several temporary running engine alarm overrides to ensure a confident restart of the engine, which could confidently result in a typical restart of less than 10 seconds on the first attempt. ZTR noted that a locomotive without an AESS may have been shutdown after having idled for many hours (allowing un-combusted carbon deposits to build up in the engine cylinders), and a restart may occur after the locomotive has lost all heat and is uniformly at ambient temperature (cold). If such an engine starts on the first attempt there are no issues (other than a few seconds of black soot being burned off). If that engine doesn’t start and the attempted restarts do not follow OEM guidelines (for example cranking for more than 20 seconds, or not providing the proper cool down time of the motors between cranking events) this will have a negative affect on the life of the locomotive’s starter motors.

ZTR commented that with regard to the issue of wear, there have been reports by some railroads placing a life expectancy on an AESS-equipped locomotive’s starter motor at 18 to 30 months. The commenter stated that it is logical to conclude that an item that is used frequently will wear out faster than one that is rarely used at all, however there are other factors to consider. If one can use the 18 to 30 month starter motor life as a baseline, the cost of replacing starter motors every 2 years (estimated at less than $2,000) is easily offset by the expected fuel savings (at $2.00 per gallon, a minimum of $10,000 per year conservatively) as well as the reduced wear and tear of other rotating equipment components (ZTR noted that it has not been able to quantify these savings, but testimony from many of its customers on these unexpected benefits has confirmed this).

ZTR commented that there have been concerns expressed regarding the incompatibility of AESS systems with remote-controlled locomotives (RCLs). The commenter stated that the issue stems from the inability of the remote control systems to be unaffected by the drop in locomotive battery voltage. Briefly, there is a set-up procedure that is required with RCLs that link a locomotive with the remote control unit. A number of factors will force a system reset that essentially places the locomotive in a fail safe state and requires manual intervention to re-establish and re-enable remote control. One of these factors is a drop-out of locomotive battery supply voltage. This occurs for a few seconds during a restart where the non-charged batteries drop from a nominal 64 Volts DC to potentially under 20 volts. ZTR's AESS system, SmartStart, includes a power supply design that accommodates this by operating at a wide voltage input range accommodating the locomotive's lows and highs. RCL equipped locomotives do not have this feature, which can cause a system reset whenever a restart occurs. ZTR noted that they have been able to modify their AESS system to operate on RCLs, and they believe that the RCL's power supply can be either redesigned with the same specifications as their AESS system or coupled with an energy hold-up device to allow any AESS to take full advantage of idle reduction opportunities.

ZTR commented that some railroads may claim to have effective manual shutdown policies and will discount the added value of an AESS. The commenter stated that through co-operative studies done with railroads, in every case in addition to a railroad's manual shutdown policy, a properly designed AESS can still generate an attractive payback from savings achieved through AESS-controlled shutdown. The commenter noted that there are several reasons AESS provides additional savings beyond those of a manual shutdown policy, for example if there are many locomotives in a yard, an AESS on each one will ensure that each one is shut down whenever the opportunity arises; the commenter believes that it may be difficult for even a crew to achieve this kind of vigilance. Secondly, the commenter noted that if there is even a remote opportunity that the temperature will drop to below freezing, the manual shutdown policy will err on the side of caution and not shut down the locomotive. The commenter noted that, on the contrary, an AESS will take every opportunity to shutdown and when the temperature drops below a specified setpoint, it will restart the engine. Lastly, the commenter noted there is an aspect of management of the process that can interfere with manual shutdown, for example priorities at any given moment may supersede the effort required to shutdown and restart a locomotive, leading to many lost opportunities of idle reduction.

ZTR commented that there are concerns that idle reduction technologies are easily tampered with, rendering them inoperative. The commenter stated that this is in fact true in unsophisticated systems; but an advanced system will monitor the health of its sensors and be integrated into the locomotive's control harness such that it is an integral component of its ability to produce power. The commenter stated that attempts to disable the AESS when equipped with anti-tampering options will cause the locomotive itself to be unable to produce power for tractive effort. The commenter noted that it needs to be stressed that any very knowledgeable individual intent on disabling an AESS or any other device on a locomotive can potentially succeed.

ZTR also noted that if the mandatory idle reduction technology application is part of a Tier 'x' compliance kit, existing rules and regulations deal quite adequately with disabling, altering, modifying, not maintaining, etc. any component within the kit that contributes to emission reduction. The commenter suggested that, if the mandatory idle reduction technology is not part of the Tier ‘x’ kit but mandatory during the rebuild of a locomotive, to comply with the spirit of the law the installed AESS should require integrated reporting and diagnostic capabilities providing feedback on its effectiveness and be designed to limit tampering opportunities.

The Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, and Northwest District Association Health and Environment Committee commented that they believe unnecessary engine idling should be curtailed by automatic shut-off mechanisms. The New York State Department of Environmental Conservation commented that it also supports the proposal requiring AESS systems to reduce locomotive idling. The commenter stated that minimizing idling has many benefits in addition to reducing emissions of air pollutants, such as reducing fuel consumption and nuisance noise. The People for Puget Sound commented that anti-idling technology is available and should be required, especially for the human-populated areas adjacent to rail yards (the commenter noted that voluntary efforts are already underway – for example, the Tacoma Rail in Washington). The Puget Sound Clean Air Agency also commented that it supports the requirement for idle reduction technology. The commenter suggested that AESS should be required for remanufactured existing locomotives even if they are owned by a small business.

CARB commented that it supports EPA’s proposal to require idle reduction devices on all new Tier 3 and 4 locomotives. The commenter also recommended requiring the installation (retrofit) of an idle reduction device on all existing regulated locomotives upon remanufacture. The commenter noted that, in general, purchases by railroads of Tier 0 through 2 locomotives were ordered with idle reduction devices. The commenter further noted that because of CARB’s 2005 agreement with Class I railroads (Burlington Northern Santa Fe (BNSF), and Union Pacific Railroad), nearly all intrastate locomotives in California will be equipped with idle reduction devices by June 30, 2008. The commenter stated that fuel and emission benefits achieved through the use of idle reduction devices are widely recognized; and noted that the fuel savings alone, after several years of use, easily offsets the cost of the device. CARB commented that the cost benefits are even greater when accounting for the added benefit to public health from reduced emissions. The commenter noted, however, that freight interstate line-haul locomotives move throughout the country, thus the commenter believes that there is a need for a standard that ensures the full nationwide implementation of these cost-effective emission reductions. CARB commented that it supports the need for a national requirement of idle reduction devices on all new Tier 3 and 4 and other regulated line-haul locomotives upon remanufacture.

A number of private citizens commented that their neighborhood is located adjacent to a switchyard operated around-the-clock primarily by CSX. The commenters stated that the neighborhood has been trying to work with CSX for over 2 years to affect some sort of change in CSX’s policy of extended idling (which has been as long as 46 hours straight). The commenters stated that their efforts have been largely ineffective and they are frustrated by the constant noise and stench of diesel fuel; thus they welcome any new regulations that limit idling and emissions from locomotive engines.

AAR commented that a major change in the railroad industry in recent years has been the widespread adoption of idle reduction technology. The commenter stated that deciding when to shut a locomotive engine down is not a simple matter. One critical issue is ambient temperature; locomotive coolant generally does not have anti-freeze and, as a result, in freezing temperatures locomotives run to prevent the coolant from freezing. Other factors include the necessity to keep locomotives idling to maintain air brake pressure, keep the locomotive battery charged, and be ready to move a train, inasmuch as the time needed to restart a locomotive consist can be considerable. AAR commented that railroads have had manual shut-down policies for decades, but are now utilizing technology that enables them to increase the frequency with which locomotives are shut down. The commenter noted two specific idle-reduction technologies that are currently used in the railroad industry. First, AESS monitors idling time, water temperature, battery status, and air brake pressure, and will stop and start a locomotive when the 'set points' for these parameters have been satisfied. The second type of idling-reduction technology mentioned is the APU, which utilizes a small engine to keep coolant warm, thus permitting shut down of the main locomotive engine in freezing temperatures, and notes that CSX Transportation pioneered the use of APUs to help meet EPA emission standards. The commenter noted that the railroads have also worked with some state agencies to address emissions issues. For example, in 2005, BNSF and Union Pacific entered into a second memorandum of understanding with CARB that provided, *inter alia*, for the installation of automated idling reduction technology on intrastate locomotives (locomotives that spend most of their time in California) by June 30, 2008 in recognition of the unique air quality problems facing California and the Los Angeles region in particular.

AAR noted that most locomotives manufactured since 2001 have come equipped with AESS, and many other locomotives have been retrofitted with an AESS or an APU; further retrofitting of existing locomotives with stop-start or an APU continues. The commenter noted that AESS systems comply with specifications for stop-start, and stated that it is pleased that EPA's proposed regulations do not interfere with the industry's specifications for stop-start systems. AAR commented that it is unaware of any other industry which has engaged in such an extensive effort to control idling.

AAR commented that, although the industry has been voluntarily employing idling reduction systems, it supports making AESS systems a mandatory part of the manufacturing and remanufacturing processes, but it believes that several modifications need to be made to the regulations in the areas of: Certification, Failure of Idling Controls, Idling Control Exceptions, Stop-Start vs. APUs, and Exemption from Stop-Start (comments on these topics, and their related responses, are covered below in sections 3.1.2.2 and 3.1.2.3).

Letters:
Association of American Railroads (AAR) OAR-2003-0190-0566.1, 0479, 0510
California Air Resources Board OAR-2003-0190-0596.1, 0719
Environmental Defense OAR-2003-0190-0487, 0546, 0592.1, 0638, 0610
Kim Hotstart Manufacturing Company (Kim Hotstart) OAR-2003-0190-0588.1
National Association of Clean Air Agencies (NACAA) OAR-2003-0190-0495, 0511,

0579.1
New Jersey Department of Environmental Protection (NJDEP), Air Quality Management OAR-2003-0190-0562.2
New York State Department of Environmental Conservation, Office of Air Resources OAR-2003-0190-0583.1
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0512, 0551.1
Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, Northwest District Association Health and Environment Committee OAR-2003-0190-0593.1
Oregon Department of Environmental Quality, Air Quality Division OAR-2003-0190-0506
People for Puget Sound OAR-2003-0190-0649
Private Citizens OAR-2003-0190-0398, 0717
Puget Sound Clean Air Agency OAR-2003-0190-0484
ZTR Control Systems OAR-2003-0190-0564.1

Our Response:

We are pleased that a number of commenters agreed with our proposal to require idle reduction technology, specifically, AESS systems on all new Tier 3 and Tier 4 locomotives, and on all existing locomotives that are subject to our new remanufactured engine standards. Our regulatory duty cycle indicates that a line-haul locomotive idles 38% of its operating time, and a switcher locomotive idles nearly 60% of its operating time. AESS will provide substantial reductions in idle time for both types of locomotives, and this reduction in idle time will provide many benefits, including: reduced emissions, reduced fuel and oil consumption, and reduced noise, especially around rail yards, many of which are located in urban neighborhoods, close to where people live, work, and go to school. AESS is an especially attractive option to reduce idle given the short payback time it offers through reduced fuel consumption. In most cases, this technology is expected to pay for itself in a few years, and this payback time will only decrease as the price of fuel increases. AESS systems will continue to provide added public health benefits and fuel cost savings throughout the life of the locomotive.

3.1.2.2 Need to Include Additional Idle Reduction Technology to AESS

What Commenters Said:

Kim Hotstart commented that in the “Overview” section of the NPRM (72 FR 15942 and 15973-4), only two idle reduction technologies are discussed; AESS systems and APUs. To provide an overview of all major technologies, the commenter stated, electric-driven heating systems should be included in this discussion. The commenter noted that EPA recognizes these systems on the website at: www.epa.gov/otaq/smartway/idlingtechnologies.htm (under “Locomotive Idle Reduction Systems”, “Stationary”, and “Electric Driven Heating Systems”). This technology works by using shore power (stationary source power) to power an electric immersion heater and a pump to circulate the coolant throughout the engine water jacket. The system keeps the water jacket temperature above 100ºF even in cold ambient temperatures. The commenter stated that these systems have probably reduced more total emissions than any other idle reduction technology since their introduction in 1965 and, depending on the options installed, are a low cost alternative that provides fast payback from fuel savings. The commenter noted that to operate the system, the crew shuts down the idling locomotive and plugs the system into shore power; after the layover period, the crew unplugs the system and restarts the locomotive, thereby leaving the locomotive engine shutdown for the entire layover period.

In its comments, Kim Hotstart also discussed that in addition to its shore power idle reduction technology, it has also developed a diesel driven heating system (DDHS), which is a type of APU that uses a small diesel engine to generate heat to keep the locomotive engine above 100ºF and has been installed on locomotives since 1998. The commenter also described a new lower cost model it has recently introduced that uses a smaller diesel engine than their earlier model and suggested that EPA update the APU costs in the rule and review the economics of requiring the use of APUs in cold areas.

Kim Hotstart recommended that EPA require engine heating systems on locomotives that operate in cold areas. The commenter noted that ambient temperature is a big factor in idle reduction. Further, an AESS system is limited in its ability to provide idle reduction in cold weather because it has no inherent heat source—the only way to maintain engine temperature is to restart/idle the locomotive. The commenter stated that a typical parameter in an AESS system is to restart the locomotive if the engine temperature drops below 100°F. In colder weather, the engine temperature will drop below 100°F faster and so the AESS system will restart the locomotive more often. The commenter noted that each time the AESS restarts the locomotive it will not shut it back down until all of the required system parameters are satisfied including elapsed time (typically 15-30 minutes). Kim Hotstart commented that another typical AESS parameter is to maintain locomotive idling if the ambient temperature is below freezing. Thus, the commenter stated that, instead of a universal requirement that AESS systems be installed on all locomotives regardless of ambient temperatures, engine heating systems should be required on locomotives that operate in cold areas. The commenter suggested that an "engine heating system" could be defined by EPA to be "any EPA-recognized device that provides a source of heat to the engine allowing it to stay shutdown for a prolonged period of time in cold ambient temperatures." Devices such as electric driven heating systems and APUs such as Kim Hotstart's DDHS would be included in this definition.

Kim Hotstart also commented that it does not recommend that engine heating systems be included as part of emissions retrofit kits due to the time and cost involved in certifying multiple kits for multiple models and applications. The commenter instead proposed that a railroad be able to choose what type of engine heating system works best for its type of locomotive, ambient temperatures, and operation.

Teleflex Ecotrans commented that it supports EPA's recognition of the fact that an APU achieves "a further reduction in idling" and commented that this further reduction is not only achieved in colder operating conditions but is additionally a superior solution in warmer operating conditions as well. Teleflex is a provider of idle reduction solutions including APUs, engine shut-down timers, cab comfort technologies and AESS systems. The commenter noted some characteristics of locomotives with APUs installed while operating in colder conditions. First, the commenter noted that in colder operating conditions an APU-equipped locomotive will experience greater locomotive engine shut-down time versus an AESS by definition because the APU-equipped locomotive engine is not required to start in order to maintain the parameters necessary for locomotive life support (thus, the APU's smaller engine will produce fewer emissions than the locomotives larger engine). Second, the commenter stated that, during periods of locomotive shut-down, an APU-equipped locomotive operates in "sentry" mode—while the APU monitors the locomotive's operating parameters, the APU will be available for use but may not be running since the APU's engine need not run if the locomotive engine life-support parameters have been met (i.e., with an APU, one hour of locomotive shut-down does not equal one hour of APU engine run). The commenter noted that, based on data obtained from APU-equipped locomotives operating with a railroad in Alaska, the APU engine typically only runs about 20 minutes for every hour that the locomotive is shut down during the coldest of operating conditions. Third, the commenter stated that, as a safeguard, the logic associated with the operation of an AESS typically prevents the locomotive from shutting down where/when the ambient temperature is 40°F or lower. The commenter stated that an AESS equipped idling locomotive may actually be even more dependent on region and temperature than an APU, because start/stop-equipped locomotives in colder climates (below 40°F) often do not shut down for days at a time during the winter months thus eliminating the opportunity for idle reduction. Lastly, the commenter noted that an APU-equipped locomotive is capable of providing hotel power for heaters and other cab comfort items without starting the large main locomotive engine; it is further used to supply power for items such as microwaves and toilet compartment heat without producing the higher emissions associated with running the large main engine, thus adding operator comfort.

Teleflex Ecotrans also noted two characteristics of warmer operating conditions. The commenter first noted that an APU-equipped locomotive is capable of providing hotel power for air conditioning and other ancillary equipment that would otherwise require the locomotive engine to run, which reduces fuel consumption and emissions. The commenter stated that the cab temperature may increase as weather conditions or climate change takes place; this existing or potential use of air conditioning can negate a substantial portion of the emissions reductions that could otherwise be garnered with the use of a stop-start system. Conversely, the commenter noted, the APU can be made to run in these conditions without using the larger main locomotive engine. The commenter stated that the APU's added benefit of being able to deliver adequate Alternating Current (AC) power eliminates the need for inverted Direct Current (DC) power to run the air conditioner (and the commenter noted that, historically DC power inverter system has also been prone to failure). Secondly, Teleflex Ecotrans commented that as locomotives age, locomotive batteries frequently fail to hold adequate charge so the need then arises to re-start locomotives more frequently with a start/stop system. The commenter noted that an APU-equipped locomotive reduces the need to re-start the locomotive because it is capable of charging the locomotive's batteries from its own small and efficient diesel engine (and thus further reduces emissions).

Teleflex Ecotrans commented that it is committed to working with EPA to supply data to support its position that the APU is a superior four-season, all-climate solution. Teleflex Ecotrans also commented that it is a dedicated provider of both AESS and APU technologies. Because of that commitment, the commenter stated that any serious locomotive idle reduction regulation initiated by EPA should provide choice and incentives for superior performance. The commenter stated that such a performance-based program can be established to encourage locomotive operators to make their own wise and committed choices to deploy superior idle reduction technologies that suit their individual applications, regions, and operating conditions.

Teleflex Ecotrans further noted that the railroad industry is already one of the highest capital-intense industries. The commenter stated that competition for resources to be re-invested in the industry's private infrastructure and technology necessary for safety and efficiency can conflict with environmental goals. The commenter suggested that one possible solution would be to develop a subsidy program whereby EPA or another agency/authority assists with the increased capital cost of superior APU technology. Teleflex Ecotrans commented that it has extensive experience in Emissions Reduction Credits (ERCs) and recommends this option as a preferred solution. In such a program, non-capped mobile emitters such as railroads could earn ERCs within designated areas where emissions reductions exceed EPA idle reduction mandates. The commenter noted that a successful program has been developed by the province of Ontario, Canada which allows for the earning and trading of mobile source emissions credits. The Ontario program has been developed such that excess or surplus emissions reductions earn credits that are bankable and saleable, and further allows these credits to be earned by both stationary and mobile emitters. The commenter stated that the program represents minimal cost to the government, lowers emissions, provides incentives for the transportation sector to willingly and deliberately reduce emissions, lowers the overall cost of compliance, and provides for savings to the electrical power generation and industrial sectors which can in turn be passed on to the consumer.

Teleflex Ecotrans commented that it believes these same benefits could occur in U.S. nonattainment areas. The commenter further noted that EPA has historically supported, and continues to support, the concept of emissions trading. The commenter suggested that EPA thus support the notion that non-capped emitters such as the railroads be allowed to earn credits and trade in this market. Teleflex Ecotrans contended that since its APU units can be equipped with a Global Positioning System (GPS) and satellite communications technologies, locomotive position and other key data have been (in the case of the Ontario program) and could be relied upon in the U.S. to prove the emissions reductions achieved as compared to the baseline that may be mandated. The commenter stated that, with the added incentive provided by the ability to earn and trade ERCs, locomotive operators would be encouraged to adopt the superior APU idle reduction technology of their choice and thereby potentially increase the reduction in idle emissions that EPA originally targeted.

NJDEP noted that in June of 2004, EPA requested public comment on whether to require idling reduction technologies for the rail sector, citing public demand to reduce idling as the driving force for regulation and noting that much of rail idling occurs in urban rail yards where exposure to diesel particulate matter is highest. EPA also noted at the time that locomotive idling technology was available for use and feasible. The commenter noted that since 2004, numerous studies have documented the human health risks to citizens living near rail yards, and that unfortunately, railroad companies have been slow to utilize locomotive idling reduction technologies, despite the fact that these technologies are widely available and cost-effective. NJDEP believes that now is the time for EPA to incorporate APU locomotive idling technologies into its national diesel reduction program since the rail industry has failed to do so. The commenter also noted that some states (e.g., California and Massachusetts) have adopted idling reduction laws that have been overturned, leaving federal regulation as the best available method to achieve reductions in health risk.

NJDEP commented that if EPA decides not to require APU idling technologies for new and remanufactured locomotive engines, it would like EPA to identify rail yards with the potential for high particulate emissions and require this subset of railroad companies to utilize APU idling technologies.

NACAA strongly urged that EPA require the installation of APUs in railroad yards, at least in conjunction with the new Tier 4 standards.

Environmental Defense, NRDC, et al. commented that they support requiring that "some subset of new locomotives be equipped with APUs where feasible and beneficial" and/or use of other reduction technologies that would achieve an equal or greater reduction to that gained by use of an APU.

NESCAUM stated that it disagrees with EPA's proposal not to require installation of APUs in any circumstance. NESCAUM stated that because of the common occurrence of sub-freezing wintertime temperatures, it expects that locomotive engines in the Northeast equipped with AESS would be subject to frequent restarts in order to prevent coolant temperatures from dropping to undesirable levels. In contrast, the commenter noted that if these locomotives were equipped with APUs, critical systems would be supplied with essential power and heat, but emissions would be reduced. The commenter suggested that, at a minimum, APUs should be incorporated into new locomotives in conjunction with Tier 4 technology. The commenter stated that, given the fact that Tier 4 will necessitate some redesign in any event and given the lead time before Tier 4 standards take effect, there should be ample opportunity to incorporate APUs into locomotive designs.

OTC commented that it strongly recommends that the final rule include installation of APUs on locomotive engines to reduce engine idling.

The New York State Department of Environmental Conservation expressed support for the use of APUs to further reduce idling of the main engine. The commenter stated that EPA's proposed method of accounting for APUs by substituting the APU emissions for main engine idle emissions for the fraction of time the APU will operate in place of the main engine is sound; though, the commenter cautioned EPA that certification application claims regarding APUs must be scrutinized carefully to ensure that claimed emissions reductions will be realized in the field.

The People for Puget Sound and the Puget Sound Clean Air Agency urged EPA to require both AESS technology and APUs on remanufactured locomotive engines. The People for Puget Sound further commented that anti-idling technology is available and should be required, especially for the human-populated areas adjacent to rail yards, and noted that voluntary efforts are already underway. The Puget Sound Clean Air Agency also noted the excessive idling emissions from locomotives without this equipment, and suggested that these technologies be applied to all new Tier 3 and Tier 4 locomotives. The commenter also stated that simply encouraging the installation of APUs is not adequate.

The North Carolina Division of Air Quality (NCDAQ) commented that it is concerned that more stringent recordkeeping and reporting requirements should be included in the final rulemaking to ensure the use of idle controls. NCDAQ's experience is that while railroad companies may install APUs on switch locomotives, the switchyards may opt to not use the APUs. The commenter stated that this leads to excessive idling at times. Thus the commenter believes that, in addition to requiring the installation of idle controls, more stringent recordkeeping and reporting requirements should also be included in the final rule to ensure the use of these controls. The commenter noted that the proposed restriction on idling for more than thirty continuous minutes applies only to locomotives equipped with AESS. The commenter stated that at least one Class I railroad is actively installing APU and AESS controls on their locomotive fleet nationwide, however not all locomotives will have both APUs and AESS controls on the same locomotive. Thus, the commenter noted, the locomotives with only an APU installed will be exempted from the proposed idling time restriction so a large portion of their fleet would not contribute to the emission reductions EPA wants to achieve. The commenter recommended that the proposed restriction on idling for more than thirty continuous minutes apply to locomotives equipped with AESS, APUs, or both types of controls.

GE commented on the request for comments on requiring APUs for some subset of locomotives. The commenter noted that, even though not required, the proposed rule provides credit for the reductions that an APU achieves in the certificate of conformity. Further, the commenter stated that it agrees with EPA's assessment there are situations where an APU may make sense, but, for many situations, the benefits provided are not sufficient to justify the costs of installation and maintenance (72 FR 15974). The commenter also stated that EPA is correct that there are design and operational complexities that require some showing of meaningful benefit before diverting resources toward their development. GE commented that it believes that the proposed approach of providing credit when APUs are installed is likely to encourage their installation when it makes the most environmental and economic sense and recognizes that AESS is generally a superior approach in that it requires significantly less maintenance, is far more reliable, and costs less than an APU.

GE also commented that it is unnecessary for EPA to specify a particular subset of locomotives for APU installation. The commenter noted that APUs will be installed where the benefits are sufficient—the goal is to reduce idling emissions, and specifying that it be achieved through APUs is not necessary to this goal. Thus, GE stated that it supports EPA's approach of providing credit for other idle reduction approaches; if an APU meets that test and otherwise makes sense, it will be installed and credit may be provided in the certificate of conformity.

Regarding the request for comment on whether the use of APUs "where feasible and beneficial" should be required, AAR commented that the answer is no. The commenter stated that this is because some railroads have not found APUs to be cost-effective. The commenter stated that EPA appears to be hinting at the possibility of requiring APUs in cold-weather climates. AAR noted that line-haul locomotives do not stay in fixed locations - they can be in a cold weather climate one week, a hot weather climate the next; the two types of switch locomotives (the hybrid and genset locomotives) use engines that have anti-freeze and thus can be shut down in cold weather without needing APUs. The commenter stated that the added cost of an APU retrofit requirement for older switch locomotives could be a disincentive to remanufacture a locomotive.

Letters:
Association of American Railroads (AAR) OAR-2003-0190-0566.1, 0479, 0510
Environmental Defense OAR-2003-0190-0487, 0546, 0592.1, 0638, 0610
General Electric Transportation (GE) OAR-2003-0190-0590.1
Kim Hotstart Manufacturing Company (Kim Hotstart) OAR-2003-0190-0588.1
National Association of Clean Air Agencies (NACAA) OAR-2003-0190-0495, 0511, 0579.1
New Jersey Department of Environmental Protection (NJDEP), Air Quality Management OAR-2003-0190-0562.2
New York State Department of Environmental Conservation, Office of Air Resources OAR-2003-0190-0583.1
North Carolina Division of Air Quality (NCDAQ) OAR-2003-0190-0565.1
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0512, 0551.1
Ozone Transport Commission (OTC) OAR-2003-0190-0633.1
People for Puget Sound OAR-2003-0190-0649
Puget Sound Clean Air Agency OAR-2003-0190-0484
Teleflex EcoTrans OAR-2003-0190-0554.1, 0553.1

Our Response:

Some commenters have suggested that we require both an AESS and an APU or other engine heating system such as shore power in our idle reduction program. However, the amount of idle reduction an APU or shore power system can provide is dependent on a number of variables, such as: what the function of the locomotive is (e.g., a switcher or a line-haul), where it operates (i.e., geographical area), and what its operating characteristics are (e.g., number of hours per day that it operates and whether or not it returns to the same location at night). As we stated in the NPRM, we are not requiring at this time that an APU be installed on every locomotive because it is not clear how much additional benefit they would provide outside of regions and times of the year where low temperatures or other factors that warrant the use of an APU exist, and they do involve some inherent design and operational complexities that could not be justified without commensurate benefits. We are not requiring shore power systems for these same reasons in addition to the fact that few locomotives return to the same location each night where they can be plugged-in to utilize their shore power systems. We are, however, adopting the proposed provision to encourage the use of an APU or additional idle reduction technology such as shore power, by providing in our test regulations, a process by which the manufacturer can appropriately account for the proven emission benefits of a greater idle reduction technology as well as a provision that allows the use of an approved alternative stop/start system that will achieve proven equivalent idle control. Regardless of whether or not an APU is installed on a locomotive during a remanufacturing event or on a freshly built locomotive, a stop/start system must also be installed that is designed to shut off the main locomotive engine(s) after 30 minutes.

We disagree with the North Carolina comment that additional recordkeeping and reporting requirements are needed. All new and remanufactured locomotives must employ automatic shutdown features and §1033.815 requires that railroads must repair any malfunctions to this stop/start system and maintain records of such maintenance. Therefore, it is not clear what additional information the commenter is requesting that the railroads should report. It seems unlikely that any railroad that would tamper with the automatic shutdown or fail to perform proper maintenance would keep records of such intentional violations. Moreover, section 208 of the Clean Air Act provides broad authority to request information necessary to ensure compliance with the regulations. As fuel prices continue to increase, and locomotives are developed that meet Tier 4 standards, the cost savings and emissions incentives may warrant including APUs or shore power systems into the original design of the locomotive, and will certainly warrant using the systems if they are installed.

3.1.2.3 Other Comments on Our Proposed Idle Reduction Standards

3.1.2.3.1 Criteria for AESS

What Commenters Said:

AAR commented that an issue raised by the NPRM is the failure to include an important exception to the requirement to shut down after thirty minutes of idling. The commenter noted that §1033.115(g)(2) contains four reasons why a locomotive can remain idle, but the commenter believes a fifth reason—the need to maintain temperature in the locomotive cab, either for warming or cooling—is missing.

EMD stated its concerns for AESS systems and the allowable criteria for engine restart. The commenter suggested that EPA add start reservoir pressure to the proposed list of allowable reasons for restarting the locomotive, if the unit is equipped with air start. The commenter also wanted to see state of battery charge added as another allowable reason to restart a locomotive and let it idle. EMD also felt that the system must be capable of being overridden if necessary for crew safety and comfort, or to satisfy union agreements.

EMA noted that proposed §1033.115(g) requires that all new locomotives must be equipped with an automatic start/stop control; and §1033.115(g)(1) specifies that the idle control "must prevent the engine(s) from being restarted to resume extended idling." The commenter does not believe it is feasible to design such a control strategy. The commenter noted that at the time the engine is restarted, the control simply cannot distinguish between whether the engine is being restarted for the purpose of actual locomotive operation, or instead to continue idling. The commenter further noted that to be compliant, therefore, the control would have to prevent any restart attempt, since it is impossible to predict when the operator may intend the engine(s) to be restarted for continued idling. EMA stated that it believes the proposed regulatory language is unworkable, and requested that it be revised.

Letters:
Association of American Railroads (AAR) OAR-2003-0190-0566.1, 0479, 0510
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502, 0594.1, 0662
Engine Manufacturers Association (EMA) OAR-2003-0190-0545, 0503, 0575.1

Our Response:

Our final rule includes provisions allowing locomotive engine(s) restart to maintain start reservoir pressure and to maintain the state of the battery charge. To address concerns about our regulatory language regarding AESS, we are removing the provision that AESS must prevent the locomotive from being restarted to resume extended idling. Our final regulations do continue to require that the stop/start system shut off the main locomotive engine(s) after 30 minutes of idling or less.

Commenters also pointed out that it can sometimes be appropriate to allow a locomotive to idle to heat or cool the cab, and we are adopting regulations to allow it where necessary. Our implementation of this provision will rely on the strong incentive railroads have to limit idling to realize fuel cost savings after they have invested capital by installing an AESS system on a locomotive. We expect the railroads to appropriately develop policies instructing operators when it is acceptable to idle the locomotive to provide heating or cooling to the locomotive cab. We do not believe that those individuals responsible for developing railroad policies have any incentive to encourage or allow unnecessary idling. It is our intention to stay abreast of how well this combination of idle control systems and railroad policies does in fact accomplish the intended goal of reducing unnecessary idling. In general, we may consider it to be circumvention of this provision for an individual operator to use the AESS system in a manner other than that for which the system was designed.

3.1.2.3.2 AESS Included as Part of a Certified Kit

What Commenters Said:

AAR commented that, while idling control systems will be mandatory, they should not be required to be part of a manufacturer's or remanufacturer's emissions control system. The commenter stated that if locomotive manufacturers and remanufacturers are required to make stop-start part of the 'certified configuration,' manufacturers of AESS and APU systems that do not manufacture or remanufacture locomotives might find it impossible to market their systems.

The commenter also noted that there is no guarantee that remanufacturers would make available certified configurations incorporating the third-party stop-start systems or APUs that have already been installed on locomotives; in which case, the resources the railroads voluntarily invested to control idling would be wasted. The commenter noted that if idling control systems are not part of the manufacturer's emissions control system, then the emissions benefits from the idling control system will be in addition to the benefits obtained from meeting EPA's emissions standards (and the actual emissions levels will be lower than the certified levels). AAR commented, however, that it believes that locomotive manufacturers and remanufacturers should have the option of making idling control systems part of the manufacturer's 'certified configuration,' as they do today. AAR commented that there is no reason to deny a manufacturer or remanufacturer the option of using idling reduction technology, or any other technology, to meet EPA standards.

EMD commented that while it agrees that the use of AESS can be beneficial, particularly for Tier 2 and later locomotives, a requirement to include AESS systems as part of a retrofit kit would complicate the kit and slow kit development. The commenter stated that one approach to achieve AESS is to modify the locomotive control system. For modern computer-controlled locomotives, AESS is integrated into the locomotive control software. This software is order-specific, that is, each locomotive order for each railroad has unique software. The software for each order would have to be rewritten and recompiled in order to meet this requirement at the time of kit certification. The commenter also expressed concern that the industry is ill-prepared to deal with older locomotives using first generation control systems that employ outdated software and computers and may require hardware upgrades in addition to reprogramming and system integration. EMD commented that, due to these obstacles, requiring AESS for certification works against EPA's desire to have retrofit kits available at an early date. The commenter went on to state that there are already several AESS systems, some involving the use of APUs available to railroads, and that railroads have made their own choices as to which system to apply, and numerous installations have been made. EMD commented that it believes that for an emissions kit manufacturer to accommodate these prior applications, several kits would have to be developed for each locomotive model. The required application engineering on the kit manufacturers part would slow kit introduction further, added to this would be the additional cost engendered by the kit manufacturer's having to handle the AESS system in passing it from the system manufacturer to the kit buyer. Therefore, EMD recommended that AESS systems on freshly manufactured Tier 2 and later locomotives be installed at the factory. The commenter also recommended that AESS systems should not be a mandatory part of an emissions retrofit kit, but remanufactured older locomotives without an AESS system already applied are to be equipped before reintroduction to service with an idle reduction system of the owner/operator's choice. Finally, EMD noted that it has offered AESS systems as on option on freshly manufactured locomotives since 2001, and as standard equipment on all Tier 2 locomotives.

<u>Letters:</u>
Association of American Railroads (AAR) OAR-2003-0190-0566.1, 0479, 0510
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502, 0594.1, 0662

Our Response:

In our final rule, we are adopting the kind of flexible approach proposed by commenters. The regulations will allow the idle reduction requirement for remanufactured Tier 0+, 1+, and 2+ locomotives to be addressed in a separate certification apart from the certification of the full remanufacture system. Under this approach, remanufacturers would be allowed to obtain a certificate for a system that met all of the requirements of part 1033 except for those of §1033.115(g). However, since the idle controls would still need to be installed in a certified configuration before the remanufactured locomotive is returned to service, some other entity would need to obtain a certificate to cover the requirements of §1033.115(g). (This separate certification approach is somewhat analogous to allowing a motor vehicle engine manufacturer to hold the certificate for exhaust emission standards and a motor vehicle manufacturer to hold the certificate for evaporative emission standards for a single motor vehicle.) Note that manufacturers of freshly manufactured locomotives and their customers will also have the choice as to whether the AESS is installed as part of the certified engine configuration at the factory or by an aftermarket company pursuant to a separate certification before the freshly manufactured locomotive is put into service.

We are also finalizing a provision that would not require the full certification process for AESS systems that were originally installed on a locomotive prior to January 1, 2008 as long as they conform to the requirements of §1033.115(g). Systems meeting those criteria would be deemed by regulation to be covered by a certificate, whether or not we had formally issued a certificate for such systems. This is intended to address the variety of already-installed idle control systems that were not subject to regulation when installed. It is unlikely that the market would obtain certificates for all of these systems, and we see no reason why railroads should be required to scrap such systems if they function as required by §1033.115(g).

3.1.2.3.3 Failure of Idle Reduction Systems

What Commenters Said:

AAR commented that it believes that a significant issue is what happens if the idle control system stops functioning, due to the failure of a battery, sensor, or some other equipment failure. The commenter suggested that a reasonable approach would be to permit railroads to continue to operate locomotives with malfunctioning idle control systems until the next time the locomotives are shopped or until the locomotive's next periodic inspection (under Federal Railroad Administration regulations locomotives are inspected every 92 days). The commenter noted that locomotives are critical to the railroads' operations, and the time required for removing a locomotive from service, sending it to a facility equipped to make repairs, and returning it to service can adversely affect the ability of railroads to provide efficient transportation.

GE noted that a concern has been raised by its customers that including the AESS in the certificate of conformity could lead to the need to take a locomotive out of service that is critically needed if a malfunction of the AESS system occurs. GE stated that, while it expects that its systems will be reliable, it recognizes the potential financial hardship that could be faced by a railroad if it is recognized that the "stop" portion of the system is not functioning. The commenter suggested that a reasonable approach to address this concern, while still giving appropriate credit to recognize the reductions these systems achieve, would be to allow the maintenance instructions to address appropriate maintenance intervals and to state that malfunctions of the AESS that might be noticed in use can be addressed in the next scheduled maintenance event, with some specified outer time limit to address an unexpected issue. Therefore, GE believes that if EPA requires AESS technology for Tier 3 and 4 locomotives, the rule should allow servicing in the event of an AESS malfunction to occur at the next regularly scheduled maintenance interval.

Letters:
Association of American Railroads (AAR) OAR-2003-0190-0566.1, 0479, 0510
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502, 0594.1, 0662

Our Response:

The existing and proposed regulations both specified that railroads are required to perform emission-related maintenance. In response to comments, we have added to the regulations a clarification that unscheduled maintenance has to be performed in a timely manner, no later than at the next "92-day" inspection required by the Federal Railroad Administration. Railroads expressed concern that the regulations, as previously written, would have required them to immediately remove a locomotive from service to make repairs to AESS systems. This was not our intent. Rather, the maintenance provision was intended to merely require that the maintenance be performed in a timely manner, while they employ their manual shutdown policies in the interim.

3.1.2.3.4 Exemption from AESS

What Commenters Said:

AAR commented that a railroad should be exempted from the requirement to have an AESS (or an APU) if it could be demonstrated that an alternative method of idle reduction provided at least as much benefit. The commenter noted that because AESS and locomotive APUs are relatively recent innovations and as one cannot anticipate what other innovations might be coming, the regulations should not be written so as to prohibit innovation.

Letters:
Association of American Railroads (AAR) OAR-2003-0190-0566.1, 0479, 0510

Our Response:

We are finalizing the proposed provision to encourage the additional use of APUs or other alternative idle reduction technology by providing in our test regulations, a process by which the manufacturer can appropriately account for the proven emission benefits of a greater idle reduction technology as well as a provision that allows the use of an approved alternative stop/start system that will achieve proven equivalent idle control.

3.1.2.3.5 Test Cycle Changes

What Commenters Said:

EMA commented that the proposed requirement for automatic idling restrictions on new locomotives will greatly reduce the amount of time spent at idle, and so will greatly increase, on a percentage basis, the time spent in other notch positions. The commenter stated that the net result will be greater overall load factors when locomotives are operated, and reduced overall operating hours per year. Accordingly, EMA requested that the switcher certification cycle be adjusted to account for the idle-reduction requirements that will apply to new switcher locomotives. The commenter stated that this adjustment will produce a much more representative test cycle and will allow engine manufacturers to develop switcher engines with emission profiles that are more closely tailored to actual in-use operations. The commenter requested that the same test cycle changes also be implemented for line-haul certification cycle as well. EMA commented that it is prepared to work with EPA staff to develop and implement those necessary revisions to the locomotive test cycles.

GE commented that it agrees that AESS technology is available, and agrees with EPA's proposal to take AESS systems into account in the certificate of conformity. (GE commented that it is not advocating for a requirement to install AESS, rather, it is simply noting that if a customer elects this option, the manufacturer should be able to take the emissions reduction benefit into account in determining the certified emissions level.) GE stated that EPA's approach of calculating a reduction factor and applying that to the relevant notches makes sense and is a meaningful way to recognize the beneficial nature of these systems. The commenter further stated that credit for AESS is key to achieving the Tier 4 standards at the lowest possible cost to the industry.

<u>Letters:</u>
Engine Manufacturers Association (EMA) OAR-2003-0190-0545, 0503, 0575.1
General Electric Transportation (GE) OAR-2003-0190-0590.1

Our Response:

We do provide an adjustment for the use of idle reduction technology in the certification cycle by allowing the use of a reduction factor to reweight the idle notch. The decrease in percent time spent in an idle notch accommodates the reduced time spent in idle and effectively increases the weighting of time spent in other cycles. See §1033.530(c) and §1033.510 for more information on how these factors are applied when using AESS and/or APU technology on a locomotive.

3.1.3 Tier 4 Hydrocarbon Standards

What Commenters Said:

EMD commented that the Tier 4 HC standards should continue to be based upon total hydrocarbons (THC), not non-methane hydrocarbons (NMHC). EMD commented that EPA's only explanation regarding the fact that the proposed the Tier 3 and earlier HC standards need to be met on the basis of THC while the Tier 4 standards need to be met on the basis of NMHC is for consistency with other rules. The commenter stated that the effect of this seemingly simple change increases the expense for manufacturers, for negligible emissions benefit. The commenter noted that locomotive and large marine engine HC emissions are largely NMHC already. The commenter also noted that manufacturers of these engines have not been historically, and continue not to be, equipped to differentiate between THC and NMHC. EMD stated that this change in the basis for the hydrocarbon emissions standards will require manufacturers to acquire new emissions equipment for the measurement of NMHC. The commenter estimated that it would have to spend approximately $40,000 at each of five testing sites (a total expenditure of approximately $200,000) for equipment to measure NMHC.

The commenter recommended that EPA return to a THC basis for the Tier 4 hydrocarbon emissions standards for locomotives and at least Category 2 marine engines, with an adjustment in the standard values if found necessary. The commenter stated that the adjustment would likely be small; and noted that §1065.260(e) allows testers to assume that two percent of total hydrocarbons are methane, which is another indication of the triviality of this change to total emissions.

<u>Letters:</u>
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502, 0594.1, 0662

Our Response:

As EMD noted, §1065.260 of the regulations allows manufacturers to show compliance with NMHC standards by measuring THC by assuming that the mass of methane is two percent of THC. Thus manufacturers are never required to measure NMHC emissions. As such, the comments about the cost modifying test cells to measure NMHC are not relevant to this rulemaking.

3.1.4 Smoke/Opacity Standards

What Commenters Said:

SCAQMD commented that the proposed standards eliminate smoke standards for Tier 4 locomotives; the commenter recommended that such smoke standards be retained and set to zero.

The commenter noted that EPA is eliminating a situation where a failure of the smoke standard becomes easy to establish a noncompliance. (E.g., Tier 4 DPFs eliminate all visible smoke, and this is established through certification testing and compliance with a zero-emission standard; however, should the locomotive DPF fail, smoke will be visible, and if there are no smoke standards, smoke will only identify a broken DPF, trigger a warranty repair, and possibly obligate reports to EPA.) The commenter stated that, with a zero-emission smoke standard, noncompliance will be easier to rectify and would place a greater responsibility on the operator to ensure that the control device is operating properly.

AAR commented that it supports EPA's proposal not to apply opacity standards to Tier 4 engines. The commenter noted that opacity is a function of PM emissions, thus if a locomotive meets the PM standards, the opacity standards should be met as well. The commenter stated that in that sense, an argument could be made for the elimination of opacity standards going forward, particularly with respect to Tiers 2 and 3, as well as Tier 4. The commenter stated that it does however understand that opacity is a relatively "easy" way of determining that something is wrong with a locomotive as it operates, particularly with respect to PM emissions. AAR stated that the opacity standards provide the public with some comfort as to the performance of locomotives in use, thus it does not oppose continued application of opacity standards to Tier 2 locomotives and to Tier 3 locomotives. AAR commented, however, that the Tier 4 PM levels are so low that it is difficult to imagine opacity being a useful measure of a locomotive's performance. The commenter further stated that the maximum PM levels are far below the point at which there would be noticeable emissions and, consequently, it makes no sense to apply opacity standards to Tier 4 locomotives.

EMD noted that EPA proposed requiring smoke opacity testing only for locomotives that are certified to one or more particulate matter standards or Family Emissions Limit (FEL) greater than 0.05 g/bhp-hr. The commenter stated that it welcomes EPA's move in this direction, but believes that the 0.05 g/bhp-hr threshold is too low. The commenter noted that smoke testing poses an additional complication for manufacturers, particularly if facilities limitations force the gaseous emissions and smoke tests to be run separately. In such cases, smoke testing doubles the fuel use for an emissions test. The commenter noted that Tier 2 engines already show smoke certification numbers well below the applicable smoke standards; those engines are certified to a line-haul particulate standard of 0.20 g/bhp-hr, four times EPA's proposal. The commenter urged that smoke testing be eliminated for all engines certified to Tier 2 particulate emissions standards or lower.

GE commented that it generally supports the proposed CO, HC, and smoke standards, but the smoke standards are no longer needed for Tier 2 or later locomotives. The commenter stated that EPA appropriately proposed to retain the existing CO and HC standards for Tier 0, 1, and 2 engines and to extend the existing Tier 2 levels for Tier 3 and 4 engines. The commenter further stated that EPA is correct that CO reductions will likely occur as a result of the application of aftertreatment using precious metal catalysts, however it stated that EPA should not impose CO limits based on this because the actual reductions will depend on the catalyst. The commenter stated that reductions that might be achieved from the engine itself will dictate the degree to which the aftertreatment will affect CO emissions. GE commented that it believes EPA strikes an appropriate balance by acknowledging the reductions of CO that will occur as a result of achieving the NOx standards, rather than requiring additional reductions with little benefit and increased costs.

GE commented that it believes EPA appropriately finds smoke standards unnecessary at low particulate levels, and that EPA should apply this finding for any locomotive family certified at or below 0.22 g/bhp-hr (as opposed to §1033.101(c), which proposed that smoke standards apply only to locomotives with FELs higher than 0.05 g/bhp-hr). The commenter stated that EPA's premise for eliminating the smoke standards appears to be based on the application of particulate filters, because the proposed 0.05 level is consistent with the transition from Tier 3 to 4 levels (0.10 to 0.03) and DPFs will be used to meet the Tier 4 standard. The commenter stated however that smoke issues are eliminated beginning at the proposed Tier 0 line-haul particulate limit of 0.22 g/bhp-hr, as better in-cylinder mixing assures more complete combustion (and incomplete combustion is what leads to smoking). The commenter further noted that smoke is not a concern with any modern-day locomotive given their modern control and fuel systems. The commenter thus urged EPA to eliminate the smoke standard and the corresponding testing requirement for any locomotive certified under Part 1033.

Letters:
Association of American Railroads (AAR) OAR-2003-0190-0479, 0510, 0566.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502, 0594.1, 0662
General Electric Transportation (GE) OAR-2003-0190-0590.1
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0483, 0493, 0558.1

Our Response:

We do not agree that the benefits of retaining a smoke standard for very low-PM aftertreatment-equipped engines justifies the cost involved. Although it may be true that visible smoke could indicate that a filter device has completely failed, we do not believe that a standard is needed to allow this determination, and we believe that our part 1033 in-use test and compliance program (along with the pressure of public complaints to the operator), will provide a robust enough driver toward adequate mitigation of any such failures.

The commenters' argument for dropping smoke standards on pre-Tier 4 locomotives is essentially that a properly maintained engine meeting any tier of EPA emissions standards will also meet the smoke standards, and that the fuel used in conducting smoke testing is expensive. We agree that the first point is likely to be true for properly maintained locomotives but, based on the available information, we are not convinced that this argument remains valid in all cases and we are therefore retaining the smoke standards for locomotives with PM FELs above 0.05 g/bhp-hr. However, we do agree that these relationships generally hold true for engines designed to the emission standards being set in this rule, and are therefore waiving the smoke test requirement from certification, production line, and in-use testing, unless such testing is specifically requested beforehand by EPA. This provides the test cost savings sought by the manufacturers but retains the EPA enforcement opportunity if smoke should become a problem in engines subject to this program.

3.1.5 National Scenic Areas

In its comments, the Southwest Clean Air Agency advocated for regulatory language that requires locomotives and marine vessel traveling through a federally designated National Scenic Area or Class 1 Area and a major metropolitan area be designated for first application of remanufactured and newly built locomotives and marine diesel engines.

Letters:
Southwest Clean Air Agency OAR-2003-0190-0468, 0508

Our Response:

Given the high level of mobility associated with these pollution sources, and the difficulty involved in prioritizing areas in need of emissions reductions, we do not believe that such a mandated regulatory program would be practical. We do support the efforts of regional, state, and local air quality agencies to encourage the early introduction of clean diesel locomotives and vessels in their areas.

3.1.6 Staggered Phase-in of PM/NOx Standards

What Commenters Said:

EMA commented that it believes SCR systems are better developed than PM systems for deployment in very large engines. The commenter noted the example that, under Part 1039, large genset engines will be equipped with SCR systems starting in 2011, in advance of the deployment of PM aftertreatment systems. The commenter requested that EPA provide an option for locomotive engine manufacturers to elect to switch the proposed stagger of the Tier 4 standards, and to comply with the Tier 4 NOx standard first and Tier 4 PM standard second. The commenter stated that allowing this option will better align with the ongoing development of aftertreatment systems for very large engines.

Letters:
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

Our final program adopts 2015 as the implementation model year for all Tier 4 standards, and so the option discussed by the commenter is no longer relevant.

3.1.7 Tier Designations

What Commenters Said:

MotivePower, Inc requested that EPA uniquely name the new standards in the final rule, such as using Tiers 0a, 1a, and 2a to refer to the new remanufacture standards in the regulations (Part 1033). The commenter stated that using Tiers 0, 1, and 2 to refer to the newly proposed standards creates confusion over what emission standard actually applied at the date of the remanufacture, what certification fuel was used, and creates two different certifications for each tier standard – the 'old' standard and the 'new' standard. The commenter also stated that, under the definition of "New" (§1033.901), a small railroad that remanufactures a Tier 1 locomotive that has never been remanufactured into a certified configuration, is not required to meet the proposed Tier 1 remanufacture standards, but it would need to continue to meet the existing Tier 1 standards. The commenter stated that it is necessary to rename the proposed remanufacture standards to Tiers 0a, 1a, and 2a, or something similar, to make sure that the applicable certification standards are very clear on the certification sticker.

<u>Letters:</u>
MotivePower, Inc. OAR-2003-0190-0613

Our Response:

We are adopting a Tier designation convention in the final rule. The "new" Tier 0, 1, and 2 standards may be designated Tier 0+, 1+, and 2+ in contexts where confusion with the previous standards may exist, including on labels. It is also important to note that MotivePower was mistaken when it stated that Tier 1 locomotives owned and operated by small railroads would continue to be subject to the old Tier 1 standards. Such locomotives will be subject to the same Tier 1+ standards that apply for locomotives owned by larger railroads when remanufactured.

3.1.8 Steam Locomotives

What Commenters Said:

EMD offered comments on EPA's treatment of steam locomotives in the proposed rule. The commenter noted that EPA proposed excluding "historic locomotives powered by steam engines" from Part 1033, specifically the statement in §1033.5(b)(1) that "[t]o be excluded under this paragraph (b)(1), a locomotive may not use any internal combustion engines and must be used only for historical purposes such as at a museum or other public attraction." The commenter noted that EPA has also added to the definition of "remanufacture" a paragraph (v) stating that "remanufacture" can also mean "to repair a locomotive engine that does not contain power assemblies to a condition that is equivalent to or better than its original condition with respect to reliability and fuel consumption." The commenter stated that EPA should be aware that there are several steam locomotives operational in the U.S. today; and further that these locomotives are not generally in revenue service, but their operation is not confined to "a museum or other public attraction." The commenter noted that some of the major railroads maintain and operate steam locomotives for railfan trips or for public image purposes. The commenter further noted that, because a steam locomotive is more spectacular to watch when it is under load, occasionally such trips will pull a freight or passenger train.

EMD commented that operation of a steam locomotive is maintenance-intensive (a reason why they are not in general railroad use any more) and some periodic required maintenance may meet the extended definition of "remanufacture". The commenter noted that, as it is unlikely that a remanufactured steam locomotive could meet emissions standards, a locomotive whose operation is not confined to a museum could run afoul of EPA rules, and could be forced to be taken out of service. EMD commented that their contribution to the total railroad emissions inventory is negligible; and many people enjoy working on these locomotives, operating them, or simply going out to the railroad track and watching them. The commenter urged EPA not to structure the rule in a way that would inadvertently prevent the operation of the few remaining steam locomotives. The commenter further noted that in avoiding such a structure, EPA would parallel the provisions in other rules excluding hobby engines or engines used solely for competition purposes. EMD urged EPA to revert to the Part 92 provision excluding steam locomotives, defined as "historic locomotive[s] powered by . . . steam engine[s]", to make it clear that steam locomotives that operate occasionally for railfan or publicity purposes are excluded from the rule. The commenter also stated that, if EPA wished to tie it up a little tighter, a date could be added (e.g., excluding only steam locomotives originally manufactured prior to a specified date from the requirements of Part 1033). The commenter suggested that such a date should not be too early, as some of the steam locomotives in occasional operation in the U.S. were originally manufactured as late as the 1980s.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1

Our Response:

In §1033.5(b) of the regulations, we intended to exclude steam locomotives that are used for a legitimate historical purpose, including those locomotives identified by EMD. We continue to believe that the phrase "used only for historical purposes such as at a museum or similar public attraction" includes these locomotives. It is not clear how EMD sees this as excluding railfan or publicity operation since those activities would fall into the general category of public attraction. It is also important to note that other provisions in our regulations would also exclude steam locomotives if they were originally manufactured before 1973, are less than 750 kilowatt (kW), or operate only on non-standard gauge rails.

3.2 Marine Diesel Engines

3.2.1 Standards and Timing for the Overall Program

What Commenters Said:

ALA, ALA of the Northwest, and ALA of Metropolitan Chicago commented that they strongly support a faster implementation. The commenters stated that they believe EPA should accelerate the schedule for cleaner technology on new and rebuilt locomotives and marine engines, and the commenters asked why the public should have to wait a decade for cleaner new trains and boats. The commenters urged EPA to include requirements for all of the existing fleet of locomotives and marine engines to install modern pollution control equipment when the engines are rebuilt. The commenters stated that they believe that this is technologically feasible, cost effective, and will immediately reduce pollution. Lastly, the commenters stated that they believe EPA should phase in this requirement starting in 2008 for all existing engines, and with full implemented for all engines as soon as possible.

CATF suggested that EPA should finalize the new standards as soon as possible, but no later than December 2007. The commenter stated that the rule has been delayed too long already, and any further delay simply prolongs the severe human health and environmental impacts caused by under-regulated marine and locomotive diesels.

NESCAUM commented that it supports the proposed Tier 3 and Tier 4 standards for Category 1 and 2 marine engines.

CARB commented that it supports the proposed implementation timing for the Tier 3 standards, but it believes that the timing for the Tier 4 standards should be accelerated.

The Texas Commission on Environmental Quality (TCEQ) commented that it encourages EPA to proceed expeditiously toward final adoption of the rules to provide states working toward compliance with the National Ambient Air Quality Standards (NAAQS) for ozone and PM2.5 much needed emissions reductions as soon as possible.

The Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, and Northwest District Association Health and Environment Committee commented that they urge EPA not to delay the implementation timeline. The commenters called for stringent reductions in PM and NOx for the largest marine engines as soon as possible, but no later than 2014. The commenters also stated that they believe that the same stringent standards should be applied to the smaller marine vessels and all of the locomotives as soon as possible, but no later than 2015. The commenter stated that technology currently exists to enable the achievement of the accelerated timelines, and cited the EPA grant-funded seawater scrubber launched on Earth Day 2007 on Holland America's cruise ship Zaandam, a "revolutionary emissions reduction technology" capable of removing virtually all sulfur oxides and significantly reducing PM emissions: www.hollandamerica.com/media/newsRelease.do?fileName=/200704/21_Corporate_01.xml.

OEC requested that EPA finalize the rule by the end of 2007 and apply the regulations to all new and remanufactured engines.

The New York State Department of Environmental Conservation noted that EPA sought comments on whether marine diesel engines should be held to the same emission standards as locomotive diesel engines. The commenter noted that marine vessels often share common engines and components with locomotives and on-road heavy duty vehicles, which leads to efficient sharing of engine emission control technologies. The commenter stated that it believes that redesigning locomotive and on-road heavy duty emission control technology for marine use is feasible given sufficient lead time. Thus the commenter stated that it believes that locomotive and marine diesel engines can, and should, share one set of emission standards. The commenter noted that these two groups can share engines control technologies, helping lower development expenses through economies of scale. The commenter stated that unified Tier 4 locomotive and marine emission standards would help meet this goal by reducing engineering challenges of multiple emission standards and emission control components; and the commenter urged EPA to require Tier 4 emission standards no later than 2013.

A number of private citizens commented that the owners of all existing marine engines should be required to begin installing the best currently-available pollution control equipment in 2008, and that the rule should be fully implemented as soon as possible.

A number of private citizens commented that they believe that EPA must establish cleaner emission standards using state-of-the-art pollution control technology to reduce emissions from these engines by 90 percent or more.

Cummins, Inc. commented that it supports the proposed framework for the introduction of Tier 3 and Tier 4 marine emission standards. Cummins commented that it believes that the Nonroad Tier 4 regulation correctly recognized that the transfer of emission reduction technology from highway to nonroad applications takes time. The commenter stated that this is also true when considering the subsequent transfer of technology to marine and locomotive engines, especially when taking into account the unique engine design, operation, and installation characteristics of marine engines; thus, the commenter believes that the locomotive and marine proposal appropriately establishes Tier 3 emission standards for all marine engines and then provides what should be adequate lead time for the transfer of Tier 4 technologies to those specific marine engines and associated marine vessels that are most suited for aftertreatment systems.

EMD commented that standards for locomotives and ‘locomotive-like’ marine engines should be harmonized, for engines both above and below 15 liters per cylinder displacement. EMD commented that advances in the Category 2 marine engine market typically lag those in the locomotive engine market. The commenter noted that in past rules, EPA has recognized this progression (e.g., the Category 2 engine Tier 2 emissions standards lagged those for locomotive engines by two years, and the standards were harmonized so that essentially the same engine could be certified to both sets of standards). The commenter noted that the reason for this lag is that the marine industry must be more conservative for safety concerns. The commenter noted that a highway truck can pull off the road in the event of an engine failure; a locomotive road failure is a major problem, as a stopped train ties up the line of way and prevents the passage of other trains and costs mount rapidly. However, the commenter noted, life and property are seldom threatened in these types of failures—an engine failure in a marine vessel is an even more serious matter. The commenter stated that a failure on an ocean-going vessel that results in loss of steerage way can lead to the loss of the vessel and its crew, and an engine failure on a river towboat can result in loss of control of the boat and its barge tow (with potential consequences of hitting a bridge or loss of life and property).

EMD noted that the proposed rule has reversed the previous lag of Category 2 marine engine standards after locomotive standards, and has ignored the need to harmonize those standards. The commenter specifically noted the following:

- EMD believes that numerically equivalent locomotive and marine engine standards (the same numbers, in the same units) have approximately the same stringency. The marine Tier 3 NOx+HC standard for engines below 15 liters per cylinder (L/cyl) and 3700 kW is 6.2 grams per kilowatt hour (g/kW-hr), while the standard for similar locomotive engines is (in metric units) 7.8 g/kW-hr; the commenter stated that the marine standard can be expected to be substantially more stringent, limiting manufacturers' ability to develop one engine for both standards.
- For engines between 15 and 20 L/cyl, the system of cutpoints on both cylinder displacement and engine power output has resulted in a mish-mash of proposed standards. One engine here might be subject to a NOx+HC standard of 7.0 g/kW-hr, while the standard for an engine using the same technology but more cylinders is 8.0 g/kW-hr; the commenter noted that these two engines straddle the locomotive standard (i.e., one could meet the marine standard, but the other not).
- The aftertreatment-forcing Tier 4 NOx standard is effective across the board one year before the compliance date for the similar locomotive standard; and for larger engines, three years before the locomotive standard.

EMA noted that regulatory lead time is a critical requirement for any feasible program to reduce emissions from engines, as engine manufacturers need sufficient lead time to: develop the advanced emission control systems necessary to meet the new emission standards, integrate those systems into their new engine designs, test prototype models of the new systems, and establish new manufacturing processes to produce the new integrated systems in an efficient and cost-effective manner. The commenter noted that each of these steps to design and manufacture advanced low-emission engine products takes the very limited resources of time, manpower, and money. The commenter stated that if insufficient lead time is provided, the proposed emission standards become inherently infeasible.

Additionally, EMA noted that marine engine technologies are derivative from other nonroad engine technologies (such as those deployed in construction equipment), which in turn are derived from highway engine technologies. The commenter noted that the transfer of engine technology down this established pathway takes time and also involves some amount of diminishing returns with respect to the emission reductions that can be realized (because at each link in the chain of technology transfer, the operating environments and performance demands become more and more challenging, while the engine model sales volumes become less and less). The commenter stated that all of this combines to require significant lead time and somewhat less stringent standards as regulations move from highway engines to nonroad engines to marine and locomotive engines.

EMA commented that, with respect to marine engines, the NPRM compresses the lead time and stability periods for the proposed standards to the very limit of feasibility, and so establishes the earliest possible effective dates for imposing Tier 3 and Tier 4 requirements on marine engines. The commenter stated that in certain respects the NPRM provides what in other circumstances would clearly amount to insufficient lead time. The commenter used as an example the proposed 2009 Tier 3 standards for recreational and commercial marine engines rated less than 75 kW. The commenter noted that at the May public hearings, the Manufacturers of Emission Controls Association (MECA) confirmed that the tremendous workloads facing engine and aftertreatment system manufacturers, together with the time that is necessarily involved in transferring emissions technologies from one industry segment to another, preclude the deployment of aftertreatment systems for marine engines until 2015 at the earliest. EMA stated that it believes it is clear (and confirmed by third-party experts) that any tightening of the proposed implementation dates for the Tier 3 and Tier 4 standards would necessarily result in an infeasible and therefore non-implementable rulemaking.

The Makah Tribal Council noted the Makah Nation is at a major marine traffic intersection located on the tip of the Olympic Peninsula where over 9,000 diesel powered military and commercial ships (including cruise ships) pass by annually. The commenter noted that research studies conducted by the University of Washington at the Cheeka Peak Observatory indicated that NOx emissions from marine traffic could be a significant contributor to the creation of ozone moving inland from the Pacific Ocean. The commenter stated that it thus supports both the near-term and long-term tightening of emissions standards in the manufacture of all new marine diesel engines in all three categories as proposed.

Tidewater Inc. noted that commercial marine vessels are not built on an assembly line. Rather each shipyard has its own methods and techniques and each vessel is essentially custom-built. The commenter described the process of constructing a ship and noted that a large vessel can take several years to complete; this may also include time spent waiting for the construction yard to free up a building berth. Each vessel therefore can take years from concept to delivery. The commenter stated that it believes that the proposed implementation schedules are not practicable for the marine industry because vessels that will be impacted are already being ordered today. Tidewater noted that it presently has on order vessels with delivery dates as far out as 2010. The commenter suggested that the compliance schedule for each new engine tier be adjusted to allow the use of proven engines with known ancillary equipment requirements from the design stage of the vessel project.

Tidewater also noted that the purpose of the NPRM, to reduce emissions, is in practice partly being achieved by engine manufacturers tuning their engines to produce lower emissions at the expense of peak engine efficiency. The commenter stated that the costs of this loss of efficiency will increase fuel consumption as much as 5% or more. The commenter also stated that this lower performance must also be accounted for in the design of future vessels through specification of larger engines and directly affects the marketability of its vessels in competition with foreign vessels not subject to the rules. The commenter questioned whether or not EPA did a cost benefit analysis on this impact of these regulations; and if the cost benefit analysis justifies "the increased fuel consumption, increased costs to consumers, and potential loss of jobs to foreign competition that is not subject to the rulemaking."

The Passenger Vessel Association (PVA) commented that it believes that Tier 4 application to new builds should be mandated only after the successful development/transfer of technology has been demonstrated. The commenter noted that vessel design is a long lead-time item and knowledge of the space, weight, and ancillary equipment is necessary to properly design a craft. The commenter further stated that, without a proven Tier 4 operating history, it believes that the needs of the equipment are unknown and therefore the design of the vessel is highly problematic.

The Overseas Shipholding Group, Inc. (OSG) commented that it supports the efforts to reduce emissions from ships, but the commenter raised the concern that the proposed regulations rely on the application of technologies that are not yet developed for the marine environment. The commenter noted that deliveries of new OSG U.S.-flag vessels stretch to 2012 and it is not clear how the ship building and engine manufacturing industries will meet the requirements. The commenter further noted that these uncertainties create considerable problems in the series construction of vessels. The commenter suggested that EPA consider implementation of new requirements by vessel construction contract date, which is typically used for ship building regulations.

The Offshore Marine Services Association (OMSA) noted that the preamble at page 15975 states that in most cases the marine diesel standards will follow the corresponding nonroad standards by one or two years. OMSA commented that it believes that, due to the much smaller market for marine diesel engines as compared to the land-based market, even two years may not be enough time to prove the land-based applications and convert them to marine operations. The commenter also noted that offshore vessels operate in warm to very warm waters such as the Gulf of Mexico, which already present a technological barrier to the ability of a vessel design to meet the system cooling and ancillary equipment requirements of current Tier 2 systems, much less the more demanding anticipated requirements of Tier 3 and Tier 4 systems.

Bollinger Shipyards Lockport LLC (BSL) commented that in new construction, since they initially have a preliminary design phase, they can implement a design spiral on paper where they can account for and develop a build strategy that will provide the requisite space, weight, and design parameter allocations (however this will not be without cost impacts). The commenter stated that it believes that most of these hurdles can be overcome, but it feels that their impact that will directly affect U.S. shipbuilders' ability to compete in the global marketplace.

Letters:

American Lung Association of Metropolitan Chicago OAR-2003-0190-0518
American Lung Association of the Northwest OAR-2003-0190-0482
American Lung Association (ALA) OAR-2003-0190-0509
Bollinger Shipyards Lockport LLC (BSL) OAR-2002-0190-0520
California Air Resources Board (CARB) OAR-2003-0190-0596.1, 0719

Caterpillar Inc. OAR-2003-0190-0485, 0498, 0580.1, 0591.1
City of Houston, Bureau of Air Quality Control (Houston BAQC) OAR-2003-0190-0561.1
Clean Air Task Force (CATF) OAR-2003-0190-0499
Cummins Inc. OAR-2003-0190-0501, 0559.1, 0653
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502, 0594.1, 0662
Engine Manufacturers Association (EMA) OAR-2003-0190-0545, 0503, 0575.1
Environmental Defense OAR-2003-0190-0487, 0546, 0592.1, 0638, 0610
Makah Tribal Council OAR-2003-0190-0472
New York State Department of Environmental Conservation OAR-2003-0190-0583.1
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0512, 0551.1
Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, Northwest District Association Health and Environment Committee OAR-2003-0190-0593.1
Offshore Marine Service Association (OMSA) OAR-2003-0190-0490, 0611.1
Overseas Shipholding Group, Inc. (OSG) OAR-2003-0190-0589.1
Oregon Environmental Council (OEC) OAR-2003-0190-0652
Passenger Vessel Association (PVA) OAR-2003-0190-0507, 0576.1
Private Citizens (*various*)
Texas Commission on Environmental Quality (TCEQ) OAR-2003-0190-0612.1
Tidewater Inc. OAR-2003-0190-0557.1

Our Response:

We have considered the many comments we received supporting our proposed marine engine standards and timing, or arguing for different standards/timing. Many state and local air quality agencies and environmental organizations argued that earlier implementation of Tier 3 and Tier 4 technologies is feasible and emphatically needed to address the nation's air quality problems. Some pointed to advanced technology demonstrations already being made on marine vessels. We have reviewed the available information provided in comments and elsewhere and have concluded that the standards and timing we are adopting in the final rule, which include some modifications from the proposal, are feasible and appropriate under the Clean Air Act, as discussed in detail in section III of the preamble to the final rule and in Chapter 4 of the Final RIA. See also Chapter 10 of this document for detailed responses to comments on feasibility concerns, and Chapter 8 of this document for additional discussion on our legal authority and responsibility with regard to lead time and stringency of the standards. We note that some of the modifications from the proposal, such as a pull-ahead of Tier 4 NOx for 2000-3700 kW engines, involve an increase in stringency. In these cases our own feasibility analysis is supported by manufacturer comments, as detailed below.

We are sensitive to manufacturer concerns regarding the degree to which our program forces an engine manufacturer to design medium-speed engines to meet marine diesel standards differently than for locomotive standards. We have included in the final rule a provision allowing locomotive-derived engines to meet alternative marine standards that are closely aligned with the locomotive standards, and adopted other changes to standards and implementation dates that also serve to more closely harmonize the standards for these two sectors. We believe these provisions serve to keep these two programs substantially harmonized.

In response to comments about impacts of our standards on new vessel construction, we agree that vessel builders will need to consider the requisite space, weight, and other design parameters for new vessel designs, especially in order to accommodate the Tier 4 catalyst-based technologies, as reflected in our engineering and cost analyses. And further we agree that, in the process, new vessels will become incrementally more expensive to build. However, we disagree with the assumption that this higher cost will significantly affect U.S. shipbuilders' ability to compete in the global marketplace. U.S. shipbuilders will not need to comply with these standards for vessels that will be registered under another flagging state besides the U.S. Hence, these regulations will not place any additional cost or burden on these shipbuilders for vessels they manufacture to compete with shipyards outside of the U.S. For vessels that will be registered in the U.S., they will have to comply with these regulations but so will any other shipyard building vessels for this purpose. Please see our Economic Impact Analysis summarized in the Final RIA for this rulemaking to see our estimates on the overall sales of commercial vessels due to our regulations. Concerns about the impacts of aftertreatment technologies on *existing vessels* are noted, but we are confident that these technologies will not be needed under our existing vessel remanufactured engine program. Please see section 10.3 of this document for more specific responses to the comments on new vessel design impacts. Based on our discussions with engine and vessel manufacturers throughout this rulemaking, and on the written comments received, we do not agree with comments claiming that warm water operation creates a technological barrier to the ability of a vessel design to meet the system cooling and other needs for Tier 2 compliance today, or of Tier 3/Tier 4 compliance in the future.

Regarding Tidewater’s comments about how the new standards affect fuel economy and the consideration of these impacts in our cost-benefit analysis, we have indeed analyzed these costs and their impacts, and refer the reader to Chapters 5 and 6 of the final RIA for details. The commenter did not provide a basis for the 5% expected impact, and our own analysis shows a much lower expected impact. See also our response to comments on fuel consumption impacts in Chapter 11 of this document.

In response to vessel builder comments regarding the long lead time needed to plan and complete a vessel and the uncertainty this creates with Tier 3 and Tier 4 engines far from designed today, we point to our analysis in Chapter 4 of the RIA showing that Tier 3 designs will not differ greatly from Tier 2 designs with respect to parameters of most concern to vessel designers such as size, shape, weight, cooling needs, and maintenance. We note too that the implementation of Tier 2 standards has occurred smoothly, even though Tier 2 engine designs were also not completely finalized many years before the standards took effect. Tier 4 engines will differ more significantly, but there is additional lead time in our program before Tier 4 begins. It is important to also note that, for purposes of determining which tier of engine must be installed, the year in which the keel is laid (or the vessel is at a similar stage of construction) applies, not the vessel completion date or entry into service date.

See our response to comments in section 3.1.1 regarding comments we received encouraging us to expedite the final rule.

3.2.1.1 Tier 3

What Commenters Said:

Commenters generally supported the proposed Tier 3 marine standards. Most commenters stated that they believe that the proposed standards are achievable, however some commenters requested that EPA accelerate the compliance deadlines.

OTC recommended an earlier compliance date of 2013 for the Tiers 3 and 4 marine diesel standards.

Houston BAQC commented that it believes EPA should accelerate the compliance dates for Tier 3 marine engines (both Categories 1 and 2) for the proposed PM, NOx, and HC standards based on kW ratings, because the dates can be met. NESCAUM also commented that it encourages EPA to consider accelerating the Tier 3 implementation dates.

Environmental Defense, NRDC, et al., Friends of the Earth, the San Joaquin Valley Unified Air Pollution Control District, ALA, ALA of the Northwest, and ALA of Metropolitan Chicago all commented that they strongly encourage EPA to adopt Tier 3 standards for NOx and PM as soon as possible, but no later than 2012. Environmental Defense, NRDC, et al. also stated that they believe these emissions levels are feasible and cost-effective using existing emission control technologies (e.g., cooled-EGR for NOx control, diesel oxidation catalyst (DOC), and DPF technologies for PM control) and improved engine designs.

NRDC urged that Tier 3 standards for PM and NOx (relying on cooled EGR, which enables a 50 percent reduction) be implemented concurrently as soon as possible, but no later than 2012.

SCAQMD commented that it believes that the proposed Tier 3 standards should also be accelerated to provide expeditious progress toward attainment of the federal ambient air quality standards in accordance with the implementation schedule for the Tier 3 nonroad engine standards. The commenter noted that Tier 3 standards will apply to the majority of nonroad engine size categories (i.e., 50 to 750 hp). The commenter stated that it thus believes that Tier 3 marine engine standards should also take effect around the same timeframe as required for nonroad diesel engines (i.e., 2008 to 2010). SCAQMD thus recommended that Tier 3 standards be accelerated to begin in the 2008 timeframe.

MTU Detroit Diesel, Inc. and EMA commented that the proposed Tier 3 NOx+HC standard for Category 1 high-power density (HPD) engines in the 3.5-7 L/cyl category (5.4 g/kW-hr) should be reconsidered. The commenters noted that, as stated in the NPRM, standard-power density (SPD) engines account for roughly 3.5 times greater domestic production volume than HPD engines, and that, in order to achieve equivalent emission reductions, greater resources are required for HPD engines, thus the increased Tier 3 stringency for the 3.5-7.0 L/cyl HPD will require an increase in complexity as well as cost and may very well decrease the rated power of engines in this category. The commenters stated that, as proposed, the emission level would raise the consumer burden for meeting these levels, and would put customers seeking this engine type at a significant disadvantage, while providing little benefit to the overall marine engine emissions inventory.

MTU Detroit Diesel proposed that the HPD standards be set at 5.8 g/kW-hr NOx+HC in the 3.5-7 L/cyl category as in the smaller displacement categories. The commenter stated that this proposal would still exceed the Tier 3 targeted 20 percent reduction in exhaust emissions for marine engines. The commenter also proposed that, for compensation purpose in the SPD chart, the standard should be set to 5.4 instead of 5.8 for all Category 1 engines above 75 kW. EMA proposed that the NOx+HC standard for these HPD engines be set at 5.8 g/kW-hr, but with an additional reduction in the applicable PM standard (from 0.12 g/kW-hr to 0.11 g/kW-hr), thereby addressing the Agency's stated priority to attain further near-term reductions in PM emissions.

EMD commented that it believes that EPA should simplify the Tier 3 standards structure to facilitate compliance by engine families with models of differing numbers of cylinders.

OMSA commented that it believes that the time delay from land to marine operations should be expanded to at least five years, with an analysis of the effect of Tier 2 on vessel design prior to the implementation of Tier 3.

PVA commented that it understands that EPA, through long dialogue with engine manufacturers and other stakeholders, has concluded that achieving Tier 3 goals can be accomplished within the engine. The commenter stated that it is concerned primarily about cost, availability, and replacement strategies; the commenter noted that any slippage or failure to achieve that goal must not penalize industry through engine non-availability or operating restrictions.

Letters:
American Lung Association (ALA) OAR-2003-0190-0509 (hearing)
American Lung Association of the Northwest OAR-2003-0190-0482 (hearing)
American Lung Association of Metropolitan Chicago OAR-2003-0190-0518 (hearing)
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502 (hearing), 0594.1, 0662
Engine Manufacturers Association (EMA) OAR-2003-0190-0545 (hearing), 0503 (hearing), 0575.1
Environmental Defense OAR-2003-0190-0487 (hearing), 0546 (hearing), 0592.1, 0638, 0610
Friends of the Earth OAR-2003-0190-0609
MTU Detroit Diesel, Inc. OAR-2003-0190-0573.1
National Marine Manufacturers Association (NMMA) OAR-2003-0190-0513

(hearing), 0656
Natural Resources Defense Council (NRDC)OAR-2003-0190-0489 (hearing), 0606 (hearing), 0592.1
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0512 (hearing), 0551.1
Offshore Marine Service Association (OMSA) OAR-2003-0190-0490 (hearing), 0611.1
Passenger Vessel Association (PVA) OAR-2003-0190-0507, 0576.1
San Joaquin Valley Air Pollution Control District OAR-2003-0190-0556.1
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0483 (hearing), 0493 (hearing), 0558.1

Our Response:

Most of the comments on the marine diesel Tier 3 standards had to do with implementation dates rather than the levels of the standards. We continue to believe that the careful coordination of marine Tier 3 standards with nonroad Tier 4 standards provides the best basis for the marine Tier 3 schedule. This coordinated effort leverages the engine design efforts in the nonroad sector, from which the marine engines are primarily derived, for meeting the Tier 3 standards without the added cost of dual design efforts in the nonroad and marine engine sectors that would come with earlier implementation of the diesel marine Tier 3 standards; it will ensure that the advancements in engine technology made by engine manufacturers to meet nonroad Tier 4 standards will be reflected in marine diesel Tier 3 designs with a minimum of required lead time, to adapt these nonroad technologies to the marine sector and conduct the necessary certification testing under Part 1042. In contrast, we do not believe that longer lead time periods between implementation of nonroad Tier 4 and marine Tier 3 (as much as five years from the effective date for nonroad engines was requested by some commenters) are necessary, based on our discussions with the engine manufacturers and on their written comments.

We agree with the engine manufacturer comments regarding the Tier 3 standards for 3.5-7.0 liter/cylinder high-power density engines, and have adjusted these standards slightly, to better align them with standards in other categories. We note that this provides a small decrease in NOx reductions from these engines, but a similarly small percentage increase in PM reductions. The impact of these changes is further reduced by the fact that many of these engine models move to Tier 4 requirements a few years later.

In response to EMD's request that the standards structure be simplified to avoid unnecessary multiple engine designs, we believe that the matrix structure of our standards is appropriate, as it ensures that each category in a very diverse array of marine diesel engines will be subject to appropriately stringent and feasible standards. To significantly simplify it while still ensuring feasible standards would yield a "lowest-common-denominator" outcome and a major loss in benefits. We have, however, in response to industry comments and our evaluation of the resulting impact on emissions, somewhat simplified the structure of standards for engines above 2000 kW (in which EMD primarily participates), and further added flexibility to the proposed alternative compliance option based on the locomotive program. We believe these changes will help avoid costly multiple design efforts.

In response to OMSA's request that we delay Tier 3 implementation to better consider vessel impacts from Tier 2, we note that Tier 2 standards have been in effect across the spectrum of marine diesel categories for one to four years now, and industry learning experience from their implementation has been factored into the current rulemaking, both pre- and post-proposal. Further learning will occur over the next one to six years, as Tier 3 standards phase in.

3.2.1.2 Tier 4

What Commenters Said:

<u>Set Accelerated, More Stringent, or Expanded Standards</u>

NRDC commented that EPA should speed up the introduction of Tier 4 and harmonize the introduction of PM and NOx standards in all cases. The commenter suggested that, rather than waiting until 2017 for the final Tier 4 NOx standards, EPA should require that Tier 4 PM and NOx standards are fully implemented as soon as possible, but no later than 2015. The commenter stated that each year of delay between Tier 3 and Tier 4 adds an additional 700 tons of soot and 40,000 tons of smog-forming gases. The commenter also requested that similar-sized marine diesel engines should be on the same Tier 4 schedule as locomotive engines; and Tier 3 standards for PM and NOx (relying on cooled EGR enables a 50% reduction, which the commenter encourages) should be implemented concurrently as soon as possible, but no later than 2012.

SCAQMD recommended that Tier 4 standards be accelerated to begin in the 2013 timeframe.

OTC recommended that the final rule include Category 1 (C1) and Category 2 (C2) engines with greater then 25 horsepower in Tier 4 marine diesel standards. The commenter also recommended an earlier compliance date of 2013 for the Tiers 3 and 4 new marine diesel NOx standards.

Houston BAQC commented that, for C1 and C2 engines greater than 3700 kW, EPA should require compliance with the proposed 0.09 g/bhp-hr PM standard and the proposed NOx and HC standards by no later than 2013 (rather than 2014, as proposed), and then require compliance with the 0.04 gram per brake horsepower hour (g/bhp-hr) PM standard by no later than 2015 (rather than 2016, as proposed) because these dates are achievable. The commenter stated that, for 1400 to 3700 kW C1 and C2 engines, EPA should require compliance with the proposed PM, NOx, and HC standards by 2013, instead of the proposed 2016 date. The commenter further suggested that for C1 and C2 engines from 600 to 1400 kW, EPA should require compliance with the PM, NOx, and HC standards be 2015, rather than 2017. Lastly, the commenter stated that EPA should expand the Tier 4 standards to cover all C1 and C2 engines with kW ratings of 19 or above (rather than the proposed cutpoint of 600 kW).

CATF commented that it believes that Tier 4 NOx and PM standards for both ships and trains should be fully implemented by 2015.

CARB noted that final Tier 4 standards for nonroad engines over 25 hp come into effect between 2013 and 2015 with exhaust aftertreatment expected to be used to meet both NOx and PM standards. Further, the commenter noted, engines used in vessels are marinized versions of these nonroad engines. The commenter thus stated that Tier 4 standards for these marine engines should be achievable in a similar time frame or shortly thereafter. CARB commented that introducing Tier 4 standards for greater than 600 kW engines alone in 2016 would provide, statewide, an additional 4 tons per day (tpd) NOx and nearly 0.1 tpd PM in 2020, and an additional 8 tpd NOx and about 0.15 tpd PM in 2025. The commenter also stated support for the following major elements of the proposal: setting Tier 4 locomotive and marine requirements based on the best possible emissions aftertreatment control technologies at emission reduction levels similar to those required on diesel engines in on-road trucks and nonroad sources.

CARB commented that there are technical issues to overcome in applying Tier 4 aftertreatment-based standards to smaller marine engines in some applications. The commenter noted that Tier 4 standards may not be appropriate for all vessel categories, such as recreational and fishing. The commenter however stated that it believes that, for vessel types that work daily and usually close to shore (e.g., ferries, tug/tow vessels), these standards must be established so that new vessel designs will evolve to include aftertreatment technology.

OEC commented that it strongly encourages EPA to enact full implementation of the Tier 4 regulations as soon as possible, but no later than 2015.

Environmental Defense, NRDC, et al. commented that EPA should implement Tier 4 standards for PM and NOx no later than 2014 for the largest marine engines, and as soon as possible, but no later than 2015, for the smaller marine engines and for all locomotives. The commenters urged EPA to adopt final emissions standards for marine diesel engines that are as stringent as those established for similarly-sized nonroad engines in the final Nonroad Diesel Rule (69 FR 38958, June 29, 2004), and require engines to employ a similar level of engine and emission control technology.

Environmental Defense, NRDC, et al. urged EPA to expand the coverage of the Tier 4 standards to include marine diesel engines from 25 to 800 horsepower. The commenters stated that they are aware of at least three ports where a significant portion of the marine diesel emissions will not be captured by the current proposal, because so many engines are below the proposed 800 horsepower threshold: 1) a recent emissions inventory study found that 30 out of 41 harbor craft vessels operating in Boston Harbor were powered by engines of less than 800 horsepower; 2) another study prepared for the Port Authority of New York and New Jersey found that 33 out of 45 vessels were equipped with main engines rated at less than 800 horsepower; and 3) CARB estimates that excluding engines rated at less than 800 horsepower would exclude roughly 90 percent of the harbor craft engines in California ports and 40 percent of the commercial harbor craft emissions inventory. The commenters stated that they believe that excluding these engines would have widespread, significant emissions impacts because there may be other ports with engine inventories comparable to Boston, New York/New Jersey, and California. The commenters noted that, in the long run, these states and other states with significant port activities may not be able to meet their CAA requirements and provide clean air to their residents unless emissions from these engines are dramatically reduced. The commenters stated that they recognize the space constraint and technical catalyst issues that industry has raised, but they expect that the industry will be able to overcome these challenges by 2015, given the long history of industries in other regulated sectors rising to meet the innovation challenges set by regulatory standards, especially since the marine emissions control technologies are likely to be based on similar equipment developed for similar-sized nonroad diesel engines.

Environmental Defense, NRDC, et al. commented that including these 25-800 horsepower engines in the Tier 4 standard would eliminate their concern that vessel manufacturers may install several smaller engines on ships to circumvent the rated power thresholds for the proposed Tier 4 controls. The commenters stated that they believe that if all engines rated between 25 and 800 horsepower were covered by the Tier 4 standards, this circumvention issue would be resolved in a manner that protects the environment and public health and provides a fair, even playing field for all commercial marine operators.

Environmental Defense, NRDC, et al. commented that they believe their recommendations are feasible, and noted that successful use of these technologies in a variety of nonroad diesel applications and successful retrofits of these technologies in a variety of marine diesel applications show that 50 percent reductions in both PM and NOx are feasible in the 2012 time frame. The commenters requested that EPA speed up, and harmonize, the introduction of PM and NOx standards in all cases. The commenters urged EPA to require that Tier 4 PM and NOx standards are fully implemented as soon as possible, but no later than 2015. They noted that testimony, comments, and other materials provided by MECA and other industry stakeholders provide confidence that many of the emission control technologies and strategies that are either already in commercial use, nearing commercial application, or under development to meet the Highway and/or Nonroad Diesel Rules will be applicable to commercial marine diesel engines by 2015. The commenters also stated that they believe that the most persuasive statements come from MECA, because it is the association that represents companies that are actually developing and commercializing these technologies.

Environmental Defense, NRDC, et al. commented that accelerating the timetable for the Tier 4 standards will bring significant environmental and public health benefits to the nation; they stated that each year of delay between Tiers 3 and 4 adds an additional 700 tons of soot and 40,000 tons of smog-forming gases. The commenters also stated that they believe that similar-sized marine diesel engines should be on the same Tier 4 schedule as locomotive engines. The commenters further stated that they believe that marine engines above 3700 kW should be required to meet Tier 4 PM and NOx standards as soon as possible, but no later than 2014. The commenters noted that EPA anticipates that the PM standard for these engines would be met with filter technology, and they stated that such technology is already in use in many applications around the world. The commenters stated that therefore an additional two years is not needed by industry, and that a delay until 2016 for this PM standard is not necessary or warranted.

Friends of the Earth recommended that the Tier 4 standards be accelerated to require new engines to meet the standards between 2013 and 2015; the commenter also recommended that EPA expand the Tier 4 standards to include all C1 and C2 engines greater than 25 hp to meet the standards in the 2013 to 2015 timeline.

ALA and ALA of the Northwest commented that EPA should fully implement the locomotive Tier 4 clean up for PM 2.5 and NOx as soon as possible and no later than 2015. The commenter stated that these reductions would cut 90 percent of the PM emissions and 80 percent from the NOx emissions, providing enormous public health benefits. The commenter also urged EPA to require similar-sized marine engines to meet Tier 4 PM and NOx standards as soon as possible and no later than 2015, and require that marine engines above 3700 kW meet the Tier 4 requirements as soon as possible and no later than 2014 for both PM and NOx.

WDNR requested that EPA accelerate implementation of Tier 4 emission standards for new marine engines; and that EPA expand coverage of Tier 4 standards to include all new C1 and C2 engines over 25 hp.

NESCAUM expressed concern that EPA proposed to apply the Tier 4 standards only to engines greater than 800 hp (600 kW). The commenter noted that a recent Boston Harbor emissions inventory found that 30 out of 41 harbor craft vessels were powered by 800 hp or less engines; and an inventory prepared for the Port Authority of New York and New Jersey found that 33 out of 45 ferry vessels were equipped with main engines rated at less than 800 horsepower (accounting for one-quarter of the main engine emissions from the collective fleet). The commenter stated that, while there may currently be legitimate concerns regarding space constraints and catalyst performance associated with aftertreatment devices on smaller marine engines, it expects that these engineering challenges will be overcome, given sufficient lead time. The commenter requested that EPA regulate commercial marine diesel engines between 25 and 800 hp because this sector represents a significant source of emissions. The commenter stated that requiring Tier 4 controls on smaller marine engines will also obviate the need for EPA to address the circumvention issue (of vessel manufacturers installing several smaller engines on vessels in an effort to circumvent the rated power thresholds for installing Tier 4 controls). NESCAUM also suggested that EPA consider accelerating the Tier 4 emission standard implementation dates to the 2013 to 2015 timeframe, depending on the engine power rating.

NRDC commented that it believes EPA should speed up the introduction of Tier 4 engines and harmonize the introduction of PM and NOx standards in all cases. The commenter urged that rather than waiting until 2017 for the final Tier 4 NOx standards, EPA should require that Tier 4 PM and NOx standards are fully implemented as soon as possible, but no later than 2015. The commenter noted that each year of delay between Tiers 3 and 4 adds an additional 700 tons of soot and 40,000 tons of smog-forming gases. The commenter also requested that similar-sized marine diesel engines be on the same Tier 4 schedule as locomotive engines. NRDC commented that it believes that large marine engines (above 3700 kW) should be required to meet Tier 4 PM and NOx standards as soon as possible, but no later than 2014. The commenter noted that EPA anticipates that the PM standard for these engines would be met with filter technology. NRDC stated that such technology is already in use in many applications around the world, thus it does not think that the industry needs another two years to meet this standard so it does not believe that a delay until 2016 for this PM standard is necessary or warranted.

The San Joaquin Valley Unified Air Pollution Control District, relying on CARB's technical analysis, commented that it believes that EPA should strengthen the effectiveness of the rule and require Tier 4 NOx and Tier 4 PM standards by 2015.

SCAQMD commented that it supports the proposed rule and urged EPA to expand the coverage of Tier 4 standards to include all new Category 1 and Category 2 marine diesel engines greater than 25 horsepower as recommended by the National Association of Clean Air Agencies and the California Air Resources Board. However, SCAQMD commented that it believes the proposed standards for marine engines are not sufficiently stringent and do not take effect in a manner timely enough to achieve the reductions needed from these sources for the South Coast Air Basin to attain the federal PM2.5 and 8-hour ozone ambient air quality standards. The commenter noted that the state strategy for the 2007 California SIP includes NOx emissions reduction targets of 30 percent and 40 percent from commercial harbor craft in 2014 and 2020, respectively. The commenter stated that early introduction of Tier 3 and 4 engines through EPA's rulemaking will facilitate the implementation of these emission reduction targets.

SCAQMD commented that Tier 4 standards will provide the greatest benefit in reducing emissions from this source category, and believes that the implementation date should be accelerated. The commenter stated that, similar to locomotives, advanced technologies such as EGR and SCR can be developed and incorporated into the new marine engine designs earlier than currently proposed. The commenter noted that Tier 4 nonroad engine standards, which are also based on aftertreatment technologies, will become available in the 2013 to 2015 timeframe. The commenter stated that, since the vast majority of marine engines are derivatives of land-based nonroad diesel engines, the implementation dates for the proposed marine engine standards should be aligned with the effective dates for nonroad engines. The commenter stated that the only exception to this may be for marine engines which may not have nonroad engine counterparts, and suggested that these engines should receive one or two years of additional compliance time.

ALA of Metropolitan Chicago commented that it believes EPA should fully implement the locomotive Tier 4 standards as soon as possible and no later than 2015. The commenter noted that these reductions would cut 90 percent of the PM emissions and 80 percent of the NOx emissions, providing enormous public health benefits. ALA of Metropolitan Chicago and a number of private citizens suggested that EPA require similar-sized marine engines to meet Tier 4 PM and NOx standards as soon as possible and no later than 2015, and marine engines above 3700 kW to meet PM and NOx Tier 4 requirements as soon as possible and no later than 2014.

<u>Do Not Set Accelerated, More Stringent, or Expanded Standards</u>

EMA commented that it believes the proposal properly recognizes the constraints on the transfer of advanced emission control systems to marine applications, and appropriately focuses the application of the aftertreatment-forcing Tier 4 standards to those larger vessels that are propelled by engines greater than 600kW. The commenter noted that those larger vessels can reasonably be anticipated to have the space, design flexibility, operating characteristics and crew capacity to accommodate the installation and maintenance of the diesel particulate filters and SCR systems that are envisioned to be utilized to meet the proposed Tier 4 standards.

Caterpillar Inc. commented that the proposed timing of the NPRM is correct in that Tier 4 aftertreatment for these lower volume marine and locomotive applications is required only after the much higher volume highway and nonroad diesel applications are developed and demonstrated in customer applications. The commenter stated that this introductory timing is critical, and urged that it be maintained.

Caterpillar further commented that a critical area of concern to the company is the overall resource requirements that regulatory agencies effectively place on the industry when new regulations are developed and become effective. The commenter noted that the resources required to satisfy new and stricter emissions standards, certification and testing requirements, and in-use compliance requirements, can become the primary factor limiting the date of product introduction. The commenter noted that there are a finite limit on the number of qualified engineers and available test cell capacity to meet the various regulatory programs that EPA has recently promulgated (highway, nonroad, marine, locomotive, and stationary engine requirements). Caterpillar commented that it supports EPA's intention, but strongly recommends that EPA continue to monitor and account for industry resource limitations when proposing new regulatory standards and introduction dates.

Caterpillar commented that it believes that there are fundamental questions about the suitability of particulate filters for marine applications (and thus that any pull ahead of the Tier 4 particulate standards is not feasible and should not be considered). However, the commenter stated that it believes that the urea-SCR NOx aftertreatment technology is sufficiently advanced to allow considering pulling forward the NOx portion of the Tier 4 standards. The commenter stated that pull-forward of the Tier 4 NOx standard for some higher engine power categories with elimination of the Tier 3 NOx reduction for some or all greater than 600 kw applications may be feasible from a workload standpoint. Caterpillar commented that it believes that a requirement for Tier 4 NOx pull-ahead feasibility would be that the PM limits should be no lower than the Tier 3 PM emissions values proposed for each cylinder displacement category. The commenter suggested that a pull-forward of the Tier 4 NOx standard for some range of higher power vessels could bring significant NOx benefit, which could allow the NOx emission standards for the above 600 kw commercial ratings with power less than some cut-point for NOx pull ahead to remain at the Tier 2 NOx level, while still attaining the targeted Tier 3 PM levels. The commenter further noted that a pull-forward for the Tier 4 NOx standard potentially could have a power cut-point substantially below the 3700 kw of the upper horsepower class, but well above the 600 kw minimum category—the smaller that power cut-point, the more vessel designs will be impacted and the more difficult to implement aftertreatment on an orderly basis.

Caterpillar commented that it believes that any pull ahead of the Tier 4 NOx standard in a given power range will need some delay in the Tier 4 PM date to help balance the workload and to allow a period of stability in the standards; and the commenter has questions on whether such a pull ahead could be made an option. The commenter noted that its initial reaction is that a NOx pull ahead must be mandatory to prevent competitive problems, as a carefully tailored pull-ahead may result in lower NOx, fuel consumption, and CO_2 emissions for the combined fleet.

MTU Detroit Diesel commented that the proposed staggered implementation date (2014 for the Tier 4 NOx and HC standards for marine engines greater than 3700 kW, and 2017 for the Tier 4 PM standard for these engines) is necessary as emission reduction technologies and components for engines greater than 3.5 L/cyl cannot be taken directly from much smaller on-highway technologies. However, MTU Detroit Diesel commented, the relatively short proposed phase-in of the Tier 3 standards (from 2012 until 2016) for other marine engines requires that interim emission reduction technologies and components be developed specifically for those other engines. The commenter stated that these provisions are not in the best interest of manufacturers in terms of limited engineering resources and dollars, since it has more recently been determined that an intermediate step from Tier 2 to Tier 3 (a NOx reduction of 25 percent) is not necessary to reach the ultimate Tier 4 NOx limit of 1.8 g/kW-hr. The commenter noted that, for the step from Tier 3 to Tier 4 NOx levels (a NOx reduction of 66 percent), the full reduction potential of SCR would not have to be utilized. MTU Detroit Diesel also noted that reaching a Tier 3 NOx limit of 5.4 g/kW-hr with internal engine measures would result in engines with higher fuel consumption, which would mean higher fuel costs and an increase in CO_2 emissions.

MTU Detroit Diesel commented that there are ways to avoid the drawbacks of the interim Tier 3 standards for marine engines having power ratings less than 3700 kW. The commenter stated that a direct step from the Tier 2 to the Tier 4 NOx levels (7.2 to 1.8 g/kW-hr – a reduction rate of 75 percent) is technologically feasible for certain engines having displacements between 3.5-7.0 L/cyl. The commenter further stated that allowing this pull-ahead option for those engines would result in better utilization of the potential of SCR technology. MTU Detroit Diesel commented that Tier 2 engines would produce less CO_2 emissions due to the greater fuel efficiency, which would then be transferred to Tier 4 engines; and the overall sum of NOx emissions reductions under the proposal to maintain the Tier 2 standards and pull-ahead the Tier 4 NOx standards by two years results in 15 percent lower NOx emissions compared to the current proposal.

MTU Detroit Diesel thus proposed that EPA finalize an option, at the engine manufacturer's discretion, to remain at Tier 2 levels until Tier 4 standards phase-in through a two-year pull-ahead (similar to engines greater than 3700 kW). The commenter stated that, at the manufacturer's option, the Tier 4 emission levels for NOx would be pulled ahead by two years, as follows: the Tier 4 NOx standard would apply to 600-1000 kW marine engines beginning in October 2015; the Tier 4 NOx standard would apply to 1000-1400 kW marine engines beginning on January 1, 2015; and the Tier 4 NOx standard would apply to 1400-3700 kW marine engines beginning on January 1, 2014. To ensure that there would be no slippage in PM reductions, the commenter suggested that the pull-ahead option would be coupled with the Tier 3 PM emission limit of 0.12 g/kW-hr. Additionally, the Tier 4 PM standards would phase-in for the pull-ahead engines as presently proposed in the NPRM.

Cummins, Inc commented that many of the challenges associated with applying aftertreatment systems to marine engines are related to the installation of those systems in marine vessels. However, the commenter noted, unlike the Nonroad Tier 4 rulemaking where several nonroad engine manufacturers also design and manufacture nonroad equipment, there are no such integrated manufacturers in the marine market. Cummins noted that its marine application engineers and aftertreatment system engineers worked with a naval architect to better understand the hurdles associated with installing aftertreatment systems in marine applications such as the need to accommodate the added space and weight of aftertreatment systems. The commenter stated that conclusions from this work found that, given sufficient lead time, those significant challenges could be overcome for large commercial vessels. Further, for current in-use vessels where aftertreatment was not considered during the vessel design phase, the project concluded that adding retrofit aftertreatment systems or repowering with Tier 4 engines with aftertreatment would be extremely difficult, impractical, and not recommended.

Cummins also commented that, given the low sales volume of the engines in the marine market as compared to the highway and nonroad markets, especially for vessels which will utilize Tier 4 engine technologies, optional introduction schemes for engine manufacturers could result in competitive inequities. The commenter requested that EPA conduct a thorough review with all engine manufacturers and other stakeholders prior to finalizing a rulemaking that offered any scheme that could result in competitive issues.

EMD commented that it supports the timing of the Tier 4 locomotive standards in the 2015 to 2017 timeframe, but has major reservations about the 2014 compliance date of the Tier 4 standards for higher-horsepower C2 marine engines. EMD stated that its concerns stem from the lack of harmonization of the proposed standards with those for locomotive engines, and from their reversal of the normal progression of technology from locomotive engines to C2 marine engines. The commenter noted that the phasing of the aftertreatment-forcing locomotive and C2 marine engine standards also has value and precedent. The commenter noted that such standards for highway trucks will phase in between 2007 and 2010, and for nonroad machinery between 2011 and 2015. EMD noted that a representative from MECA provided testimony at the public hearings that the 2015 start date for the phasing in of such controls for locomotives and marine engines would fit well with MECA member companies' capabilities, noting that these companies would be busy with the highway and nonroad applications until then. The commenter stated that further casts into doubt the ability of engine manufacturers to meet any aftertreatment-forcing standards prior to that date.

American Waterways Operators (AWO) urged EPA to recognize that the NPRM will have a much more significant and direct impact on vessel owners and operators than the 1999 regulations establishing the Tier 1 and Tier 2 emissions standards. The commenter stated that while those regulations imposed higher costs on vessel owners who purchased new engines (because Tier 1- and Tier 2- compliant engines are more expensive than their predecessors), they were otherwise largely transparent to vessel owners and operators; the new NPRM changes that situation materially. The commenter noted that the proposed Tier 4 standards will require aftertreatment technology that has significant implications for vessel design and operations, as well as (for the first time) the possibility of the extension of emission controls to existing engines when rebuilt or remanufactured. The commenter stated that these requirements will not only impose substantial new costs on vessel owners and operators; but they will also require vessel owners to develop a level of understanding of EPA regulations that is not widely present in the industry today. AWO commented that it believes that it is critically important that EPA: (1) undertake an extensive industry outreach program to ensure that vessel owners and operators fully understand how the new approach will affect them (with sufficient lead time to promote widespread industry compliance with the regulations), and (2) develop a thorough, accurate understanding of the vessel and engine population that will be affected by the proposed regulations.

AWO commented that it understands that EPA has worked closely with the manufacturers of marine engines to arrive at emissions standards for new engines that are both environmentally protective and technologically achievable within the proposed time frames. The commenter notes that it is currently engaged in discussions with engine manufacturers to better understand their technical analysis and would expect to defer to their expertise as to the technological feasibility of the proposed Tiers 3 and 4 standards. However, AWO commented that, from its perspective, it will not be sufficient simply to confirm that engine technology can be developed to meet the new emission standards within the established time frames. The commenter stated that it will be equally critical to ensure that such technology can be marinized and used on board vessels without compromising safety or operational efficiency, particularly with respect to the proposed Tier 4 standards, which will require the use of ULSD and aftertreatment technology in order to meet the required emissions reductions.

AWO also commented that it strongly supports EPA's proposal to limit the applicability of Tier 4 standards to new engines above 600 kW given the complexity of this technology and its significant implications for vessel design. The commenter stated that below this power range, applying aftertreatment systems in marine applications becomes at best extremely impractical, and at worst utterly infeasible.

PVA noted that a large proportion of the passenger vessel industry operates with engines less than 600 kW. The commenter stated that EPA has properly determined that the typical installation for this group of vessels would not support aftertreatment. The commenter further stated that space, cost, and duty cycle all indicate that aftertreatment would be incompatible in vessel services utilizing this group of engines.

The Lake Carriers' Association (LCA) commented that, due to the wide range of engine design, vessel design, and engine installation characteristics, Tier 4 standards should not apply to engines below 970 kW. The commenter stated that below this power range, applying aftertreatment systems to marine applications becomes infeasible or extremely impractical.

The United States Coast Guard (USCG) commented that, from its experience in ship design, it would like to ensure that EPA has considered the potential significant design impacts on existing vessels to meet Tier 4 requirements proposed in 40 CFR 1042.101. The commenter stated that it is concerned that SCR and PM equipment, including urea tanks, may add a significant amount of topside weight and require substantial below deck space. The commenter stated that, due to space limitations and ventilation requirements, a significant amount of this equipment is normally located high on the vessel causing a rise in the center of gravity of the vessel and a reduction in the vessel's stability or ability to remain upright. The commenter raised the concern that, since many commercial vessels are already optimized with respect to design requirements, additional high weight may require substantial alteration or reduction in cargo/passenger capacity. The Coast Guard also commented that, due to tighter quarters in machinery spaces because of added Tier 4 equipment, there would need to be increased ventilation capacity to adequately cool equipment and prevent ignition of combustible materials as stated in 46 CFR 58.01-45. The commenter further noted that air temperature can not exceed temperature ratings of equipment as required by 46 CFR 111.01-15. Lastly, the commenter noted that it would be necessary to ensure designed ventilation also met American Bureau of Shipping (ABS) Rules for Building and Classing Steel Vessels, Part 4, as invoked by 46 CFR 58.01-5, due to the decreased differential between fuel flashpoint and ambient space temperatures, especially given the reduced flashpoint of ULSD.

Letters:
American Lung Association (ALA) OAR-2003-0190-0509 (hearing)
American Lung Association of Metropolitan Chicago OAR-2003-0190-0518 (hearing)
American Lung Association of the Northwest OAR-2003-0190-0482 (hearing)
American Waterways Operators (AWO) OAR-2003-0190-0519 (hearing), 0574.1
City of Houston, Bureau of Air Quality Control (Houston BAQC) OAR-2003-0190-0561.1
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485 (hearing), 0498 (hearing), 0580.1, 0591.1
Cummins Inc. OAR-2003-0190-0501 (hearing), 0559.1, 0653
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502 (hearing), 0594.1, 0662
Environmental Defense OAR-2003-0190-0487 (hearing), 0546 (hearing), 0592.1, 0638, 0610
Engine Manufacturers Association (EMA) OAR-2003-0190-0545 (hearing), 0503 (hearing), 0575.1
Friends of the Earth OAR-2003-0190-0609
MTU Detroit Diesel, Inc. OAR-2003-0190-0573.1
Natural Resources Defense Council (NRDC)OAR-2003-0190-0489 (hearing), 0606 (hearing), 0592.1
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0512 (hearing), 0551.1
Offshore Marine Service Association (OMSA) OAR-2003-0190-0490 (hearing), 0611.1
Ozone Transport Commission (OTC) OAR-2003-0190-0633.1
Passenger Vessel Association (PVA) OAR-2003-0190-0507 (hearing), 0576.1
Private Citizens *(various)*
San Joaquin Valley Air Pollution Control District (SJVAPCD) OAR-2003-0190-0556.1

South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0483 (hearing), 0493 (hearing), 0558.1
U.S. Coast Guard (USCG) OAR-2003-0190-0721
Wisconsin Department of Natural Resources, Bureau of Air Management (WDNR) OAR-2003-0190-0552

Our Response:

We received numerous comments objecting to our establishment of a 600 kW cutpoint for the application of Tier 4 technology, and mostly calling for the extension of this technology to marine diesel engines down to 25 hp, as was done in EPA's land-based nonroad engine Tier 4 program. The comments did not, however, address the vessel-related issues with adapting aftertreatment to smaller vessels, as identified in the NPRM feasibility analysis. We also received many comments supporting the 600 kW cutpoint, though it was clear from the variety of comments that there is no broad support for any one power rating or other engine/vessel characteristic that establishes an unquestionable boundary for Tier 4 technology feasibility. After reviewing all comments we are maintaining our conclusion that 600 kW is the appropriate cutpoint for Tier 4 technology at this time, and we are not setting Tier 4 standards for engines under 600 kW in this rulemaking due to vessel design constraints. We may do so at some point in the future if further technology developments show a path to address the issues we identify in RIA chapter 4 with the application of aftertreatment technologies to smaller vessels.

Manufacturers of large engines argued that the proposal's call for modifying the engine models under 3700 kW for Tier 3 NOx, and again for Tier 4 NOx shortly after would be too difficult. They argued that at least the largest of these engines could meet Tier 4 NOx in 2014, two years earlier, if the Tier 3 NOx+HC standard, proposed to apply in 2012, 2013, or 2014, depending on displacement, did not have to be met. We have analyzed this group of engines and agree that the suggested approach would be feasible, and would have very little detrimental effect on NOx reductions in 2012-2013, while providing significant additional NOx reductions thereafter. We are therefore leaving the Tier 3/Tier 4 PM standards as proposed, but revising the NOx implementation schedule for 2000-3700 kW engines as suggested by the industry. We believe that extending this change below 2000 kW is not appropriate because these smaller engines, more similar to their land-based nonroad counterparts, should be able to meet Tier 3 NOx levels without extensive redesign, but would be more difficult to equip with aftertreatment on an early schedule due to vessel packaging constraints and other factors. We are adopting this change as a requirement rather than as a manufacturer's option, because of competitiveness concerns about the latter raised in industry comments.

Comments about specific negative impacts on vessel design and operation arising from the use of aftertreatment devices and associated hardware are discussed in Chapter 10 of this Summary and Analysis of Comments document.

3.2.2 Specific Vessel and Marine Engine Applications

What Commenters Said:

Several commenters wrote to ask us to reconsider applying the Tier 3 and Tier 4 marine standards to new engines installed on lifeboats or used as emergency generators.

These commenters noted that the engines on lifeboats and rescue boats are typically small engines, below 37 kW, although rescue boats can have larger engines. Most of them are on ocean-going vessels, the vast majority of which are flagged outside the United States. Manufacturers of lifeboats and rescue boats informed us that certification of these boats is a two-part process with separate certification for the engines and for the vessels. In addition to meeting the emission standards, engines used on these vessels are required to undergo rigorous testing (to ensure starting in cold temperatures, running upside down, as well as crash and freefall tests) and be certified to Coast Guard and international standards to make sure they will operate in an emergency. Only a small number of lifeboats and rescue boats are manufactured each year for the U.S. market. The total global market is about 3,000 units annually, about 150 of which are sold to U.S. vessels. These manufacturers were concerned about the ability to obtain engines certified to both emission and safety standards, and the costs, both financial and in terms of time, associated with recertifying the boats with the compliant engines for the U.S. market. Because the market is so small, some manufacturers may choose to not produce boats that meet U.S. requirements, with associated negative impacts on the U.S. marine industry.

These manufacturers also noted that lifeboats and rescue boats contribute only minimally to air pollution from marine engines because they are not intended to be used except in an emergency. Otherwise, they are subject only to a short start check and about four short waterborne tests per year, and even this small amount of operation is unlikely to occur in U.S. waters. These commenters also noted that lifeboats and rescue boats are typically stored on deck, and they were concerned about the potential impacts on electronic fuel system controls and other advanced controls. One commenter noted that as engines become more complex, crew will be unable to repair them; this means that until a repair person arrives on board or the engine can be removed from the boat, repaired, and re-installed, the boat will not be in working order. In other cases, maintenance may be infrequent, which means that the engines must be reliable. They recommended that the emission controls on these engines remain “low tech” to prevent reliability problems.

These manufacturers requested that, to avoid endangering life and placing U.S. shipping and lifesaving equipment manufacturers at a serious economic disadvantage, we exempt lifeboats and rescue boats from Tier 3 and Tier 4 standards. Some also requested that, consistent with International Convention for the Prevention of Pollution from Ships (MARPOL) Annex VI, we also exempt them from Tier 1 and Tier 2 standards.

The USCG agreed with the above comments, and noted that they also apply to emergency diesel generator engines and emergency fire pump diesel engines.

Friends of the Earth commented that it believes that the timelines for implementing the Tier 4 standards should be moved up to 2009 for new passenger commuter ferries. The commenter noted that passenger ferries operate close to shore and close to people day after day in port cities such as Seattle, San Francisco, and New York. The commenter further stated that passenger ferries are more likely to expose more people to deadly diesel exhaust than other harborcraft, and are far more polluting per passenger mile than landside commute alternatives. The commenter stated that this is because marine engine regulations lag far behind other mobile sources, as noted by EPA in the NPRM. The commenter noted that a number of independent studies over the past five years have documented that taking a ferry is more polluting than riding a new diesel bus or driving a current model year car.

Friends of the Earth commented that ferries are ahead of other harborcraft when it comes to advanced air pollution technology being used on a limited basis: two new passenger ferries are currently being constructed in Seattle for the San Francisco Bay Area Water Transit Authority that will meet a standard of 85 percent below the Tier 2 requirements (nearly the Tier 4 standard). The commenter noted other passenger ferries equipped with aftertreatment currently in operation in the U.S., including the MV Solano ferry in San Francisco and the Staten Island Ferries in New York. The commenter noted that this catalytic technology has been installed in advance of requirements for marine fuels to meet the 15 ppm standard; and the commenter noted that low sulfur fuels are now required across the U.S. in land-based applications, so the commenter does not believe that there would be any obstacle to passenger ferries sourcing low sulfur diesel fuel.

Friends of the Earth commented that the federal Bureau of Transportation Statistics recently released a new National Census of Ferry Operators that documented about 260 passenger ferries operating in 33 states (not including dinner cruises or other excursion vessels). The commenter stated that the ferry market is unique and large enough to warrant its own regulatory standards; further, the costs will be born by the public, as commuter passenger ferries are typically built with public funds and subsidized with transportation monies. The commenter thus stated that it urges EPA to require new passenger commute ferries to meet the proposed Tier 4 standards in 2009. The commenter also urged EPA to require a timeline for requiring existing harborcraft engines to remanufacture, repower, and/or retrofit engines to reduce emissions to the cleanest possible engine standards beginning in 2008. The commenter stated that, because these vessels are long-lived, it is essential that the legacy fleet of mostly unregulated engines be phased out. The commenter further suggested that EPA consider the revised California proposal for harborcraft engines, requiring replacement of Tier 0 and Tier 1 engines with Tier 2 or better cleaner engines and phasing-in in the oldest, high-use engines.

OMSA noted that EPA described in the NPRM why it would not be prudent to apply the Tier 4 standards to engines less than 600 kW, or require aftertreatment on vessels equipped with these engines (72 FR 15982-15983). The commenter stated that, based on this logic, it would also prudent to exempt crewboats from the Tier 4 requirements. The commenter explained that crewboats are Coast Guard-inspected small passenger vessels used to transport personnel to and from offshore locations. These vessels often use engines of more than 600 KW and are high-speed vessels constructed of aluminum, using water-cooled exhaust to prevent overheating of the aluminum hull and exhaust system. Crewboats typically have very small engine rooms, are very sensitive to changes in weight, and have severe space constraints. OMSA commented that it believes that crewboats should be exempted from the Tier 4 standards given the fact that they have similar operating characteristics to those vessels that the rule proposed to exclude from the Tier 4 standards.

EMA recommended that aftertreatment-based standards not be applied to high-speed, high-performance government and emergency vessels, such as lifeboats and police, fire and rescue boats.

Letters:
AABENRAA MOTORFABRIK OAR-2003-0190-0549
Alexander/Ryan Marine & Safety Co. OAR-2003-0190-0661
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1
Fr. Fassmer OAR-2003-0190-0477
Friends of the Earth OAR-2003-0190-0609
Markle Marine Safety Services OAR-2003-0190-0547.1
Offshore Marine Service Association (OMSA) OAR-2003-0190-0490, 0611.1
Overseas Shipholding Group, Inc. (OSG) OAR-2003-0190-0589.1
Survival Systems International OAR-2003-0190-0657
United States Marine Safety Association OAR-2003-0190-0617.1

Our Response:

Our current marine diesel engine program does not exempt lifeboats or rescue boats. Emergency engines used in land-based application such as standby generators are also not exempt from our emission control requirements in either highway or nonroad applications.

After considering these comments, we conclude that it is reasonable to modify our program for engines used on Coast Guard approved lifeboats and rescue boats. First, our final program exempts engines intended to be used on lifeboats and rescue boats from the Tier 4 standards. This exemption is appropriate for technological reasons. We expect the Tier 4 standards to be met through the application of aftertreatment technology. While we believe these technologies will be durable and reliable, it is also the case the additional complexity could possibly affect engine performance in an emergency, which is the sole situation in which these engines would be used. For example, it would be necessary to ensure the engines on the lifeboat or rescue boat have onboard at all time an adequate supply of urea that meets the quality requirements of an SCR system. In addition, if the engine on the lifeboat or rescue boat is only run for very short periods of time for periodic onboard tests, the PM filter may not have time to regenerate. This could result in a small risk of plugging. Therefore, it is reasonable to exempt these engines from the Tier 4 requirements. It is worth noting that most lifeboat engines are less than 600 kW and thus would not be subject to Tier 4 standards.

Second, to avoid a situation in which an engine certified to the Coast Guard and International Convention for the Safety of Life at Sea (SOLAS) requirements is not available for use in a lifeboat or rescue boat application, we are providing an exemption that would have the effect of delaying the date of the emission standards for engines used on those boats until

SOLAS certified engines of the respective emissions tier become available. Specifically, we will grant exemptions for engines not complying with the Tier 3 requirements for use in a Coast Guard-approved lifeboat or rescue boat until such time as a comparable Tier 3 engine that meets the weight, size, and performance requirements of the boat is certified under the Coast Guard and SOLAS requirements. Once such an engine becomes available, the non Tier 3 compliant engines may not be sold for use in these applications. This provision is necessary because the Coast Guard has observed a precipitous drop in available SOLAS-certified engines with the emissions tier change from the Tier 1 emissions standards to the Tier 2 emissions standards. Given the high cost of SOLAS certification and the low sales of SOLAS-certified engines, engine manufacturers have delayed SOLAS certification of new emission tier engines. After considering the high cost of SOLAS certification, the need for additional lead time to complete the SOLAS certification process and the importance of lifeboats and rescue boats to safety, we have concluded it is appropriate to provide this exemption. We are not requiring engine manufacturers to certify these engines by a specified date. However, we anticipate that engine manufacturers will over time certify their Tier 3 engines to the Coast Guard and SOLAS requirements, or modify their existing Coast Guard certified engines as necessary to comply with the Tier 3 requirements. Most of the marine diesel engines used on lifeboats and rescue boats are derived from land-based highway or nonroad engines. Once the Tier 3 requirements for those engines go into effect and the Tier 2 or Tier 1 counterparts are retired from the fleet, it will become more expensive to continue to provide parts and service for these older engines, and engine manufacturers will prefer to provide newer tier engines for lifeboats and rescue boats globally. Because it is not possible to determine when that change will take place, the final program specifies that when they do become available, they must be used.

Finally, we are extending this exemption to Tier 2 engines as well. We have learned that some lifeboat and rescue boat manufacturers are having trouble obtaining engines that meet the Tier 2 standards. Note that because Tier 2 engines are not regulated under part 1042, this exemption is included in a new section in Part 94 (§94.914). As with the Tier 3 exemption, once a Tier 2 engine becomes available that meets the weight, size, and performance requirements of the boat and is certified under the Coast Guard and SOLAS requirements, the exemption will no longer be available for new engines.

Engines that are produced to an earlier tier pursuant to these provisions must be labeled to make clear that their use is limited to lifeboats or rescue boats approved by the USCG under approval series 160.135 or 160.156. Using such a vessel for a purpose other than a lifeboat or rescue boat is a violation of the regulations.

The above provisions are applicable only to engines in lifeboats and rescue boats used solely for emergency purposes. This is an important distinction because there are cases in which a lifeboat may serve dual use on a vessel, both for general transportation (e.g., tenders) and for emergencies. Engines in lifeboats and rescue boats that are not used solely for emergency purposes are not exempt. These engines are not expected to remain idle long enough for urea storage or PM trap regeneration to be a problem. For all these reasons, the Tier 2 and 3 flexibility and Tier 4 exemption will apply only to engines intended for installation on lifeboats approved by the USCG under approval series 160.135 (except those which are also approved for use as launches or tenders) and rescue boats approved by the USCG under series 160.156.

Our current program also does not exempt marine stand-by emergency generators, and we did not propose to revise that approach. For reasons similar to those for lifeboats and rescue boats, we are modifying our program to exempt marine stand-by emergency generators from the Tier 4 standards. This exemption is necessary due to the fact that, like lifeboats and rescue boats, marine stand-by emergency generators are rarely used, their operation being limited to periodic testing of several minutes duration. Many emergency generators are below 600 kW and therefore would not be subject to Tier 4 standards. However, larger emergency generators are used in some applications, particularly on large cargo vessels. While the technologies that will be used to achieve the Tier 4 standards are expected to be durable, it is also the case that operation for such short periods of time may not be enough to engage the aftertreatment regeneration strategy. In addition, these auxiliary engines would need separate urea tanks, rendering them more complicated to maintain and use in an emergency situation.

This exemption is limited to dedicated stand-by emergency auxiliary engines subject to United States Coast Guard requirements set out in 46 CFR part 112. In general, these stand-by emergency auxiliary engines are supplemental to the ships' main auxiliary engines. They are located away from the main engine compartment, have separate fuel tanks, and are connected to the ships' power system in such a way as to provide for emergency power only to emergency equipment and not the ship's power grid generally. These engines must be labeled for use as marine stand-by emergency auxiliary engines only.

Marine stand-by emergency engine means any marine auxiliary engine whose operation is limited to unexpected emergency situations on a vessel and therefore that qualify as final emergency power sources under 46 CFR 112; these engines are subject to testing and maintenance required by the United States Coast Guard. They are generally used to produce power for critical networks or equipment (including power supplied to portions of a vessel) when electric power from the main auxiliary engine(s) is interrupted. Marine auxiliary engines used to supply power to the vessel's general electric grid or that are operated on a constant basis are not considered to be emergency marine auxiliary engines.

Exempted stand-by emergency engines are required to meet the applicable Tier 3 standards (in part 89 or part 94, as applicable). See 40 CFR 1068.265 for the provisions that apply for such exempt engines. The engines must also be labeled to make clear that they are exempt and their use is limited to emergency stand-by auxiliary power as specified in United States Coast Guard requirements set out in 46 CFR part 112.

We are not revising our program with respect to fire and flooding pumps. These engines are smaller than the 600kW and therefore would not be subject to the Tier 4 standards.

We are encouraged to see interest developing around the country in outfitting advanced emission controls onto ferries, and EPA staff are working to help facilitate state and local efforts of this sort. We note that projects to date have generally been done on an individual vessel retrofit basis, with the significant extra costs and start-up challenges typically encountered in such applications. Based on our discussions with marine engine and vessel manufacturers and operators, we do not believe that the challenges of implementing Tier 3 and Tier 4 technologies on ferries are substantially different from those expected with other marine applications, and so we do not believe it necessary to set standards specifically for engine used in ferries, either more or less stringent. Furthermore, we believe the added workload burden and cost to engine manufacturers from our doing so could hamper the overall implementation of this program. See also Chapter 9 for issues specific to marine engines in use.

Although we are exempting engines installed on lifeboats and rescue boats from Tier 4 requirements, we do not believe it is appropriate to exempt engines in other vessel applications such as police, fire, and crew boats. (However, see discussion on migratory vessels in section 3.2.5. below) These vessels are in service frequently and for substantial durations, and their engines are not expected to remain idle long enough for urea storage or PM trap regeneration to be a problem. Furthermore, they are typically well-maintained by experienced technicians to ensure their reliability in performing their critical missions.

We do agree that some police, fire and crew boats share at least some of the design features we identified in the RIA that are more typical of vessels with engines under 600 kW (not subject to Tier 4 standards) than of those with engines above 600 kW. However, to shift the Tier 4 program away from engine-specific standards and more toward vessel-specific standards, beyond the very limited exemptions for special cases, would make the program impractical and potentially very costly. This is especially so in light of the non-vertically integrated nature of this market. The logical extension of a vessel-specific approach would not just exempt some vessels with over 600 kW engines, but would apply aftertreatment to some vessels under 600 kW, with dual engine designs needed, with and without aftertreatment, over a broad horsepower range. We believe such an approach would lead to vessel designs being tailored to avoid compliance with the emission regulations rather than to meet the needs of the application. Such gaming of the system would not serve the marine community or the environment well. We are confident that technical solutions to the application of aftertreatment technologies to high-performance vessels can be found, though we agree that they may require more time and attention from vessel designers, such as a shift to insulated dry-exhaust systems.

3.2.3 Foreign-Flag Vessels

EPA's current marine diesel engine emission controls do not apply to marine diesel engines on foreign vessels entering U.S. ports, and we did not propose to change that approach in this rule. Instead, we noted our intention to consider this issue in our future rulemaking for Category 3 marine diesel engines.

What Commenters Said:

Many commenters recommended that EPA change this approach and extend the marine standards to engines on foreign vessels. Commenters noted this change is needed to maximize the emissions benefits from this source category. Applying the standards to only U.S. vessels would create an unlevel playing field that may induce vessel owners to flag outside of the United States to avoid having to comply with the Tier 3 and Tier 4 standards for engines with per cylinder displacement up to 30 liters. Some stated that foreign registry should not confer the right to pollute, that it is inappropriate to leave public health and environment to the mercy of notoriously lax regulations of “flag of convenience” states, and by applying EPA’s standards to engines on foreign vessels EPA can ensure that ships not party to MARPOL Annex VI would not be subject to more favorable treatment than U.S. registered ships. SCAQMD noted that emissions from auxiliary engines on ocean-going vessels occur primarily while a vessel is maneuvering or at port, that such emissions are about 50 percent of ocean-going emissions in the South Coast Air Basin, and that these emissions contribute substantially to exceedances of the PM2.5 and 8-hour ozone NAAQS in that area. The Lake Carriers’ Association noted that by exempting engines on foreign vessels only 40 percent of the vessels operating on the Lakes would be covered, and the resulting competitive disadvantage for U.S. ships could divert cargo to Canadian carriers. AWO noted that EPA cannot achieve the emission reductions it seeks without applying the standards to foreign vessels. Some commenters noted that only by applying the standards to engines on foreign vessels will the market promote technology improvements in the industry. OMSA asserted that EPA has the legal authority to apply the standards to engines on foreign vessels.

Shipping industry commenters were concerned about the competitive disadvantage that would result from applying these standards to U.S. vessels only, stemming from increased costs of building and operating a vessel with compliant engines. BSL recommended that that the issue of applying standards to engines on foreign vessels be addressed at the International Maritime Organization (IMO) to ensure that reasonable international standards are applied to all vessels. OSG also commented that they support efforts to reduce emissions from ships and that working through the IMO is the most effective means to reduce emissions from ocean going vessels.

<u>Letters:</u>
American Waterways Operators (AWO) OAR-2002-0190-0519, 0574
Bollinger Shipyards Lockport LLC (BSL) OAR-2002-0190-0520
City of Houston, Bureau of Air Quality Control (Houston BAQC) OAR-2002-0190-0561
Clean Air Task Force (CATF) OAR-2002-0190- 0499
Crowley Maritime Corporation (Crowley) OAR-2002-0190-0641
General Electric OAR-2002-0190-0590.1
Kirby Corporation OAR-2002-0190-0563
Lake Carriers’ Association (LCA) OAR-2003-0190-0567.1
Marathon Petroleum Company LLC OAR-2003-0190-0595.1
Markle Marine Safety Services OAR-2002-0190-0547
New York Department of Environmental Conservation, Office of Air Resources OAR-2003-0190-0583.1
North Carolina Division of Air Quality (NCDAQ) OAR-2003-0190-0565.1
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0512 (hearing), 0551.1
Offshore Marine Service Association (OMSA) OAR-2003-0190-0490 (hearing), 0611.1

Overseas Shipholding Group, Inc. (OSG) OAR-2003-0190-0589.1
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0483 (hearing), 0493 (hearing), 0558.1

Our Response:

As noted above, many of the entities who commented on this issue were in favor of extending the proposed standards to marine diesel engines with per cylinder displacement below 30 liters installed on foreign vessels that operate in U.S. waters. Commenters indicated that doing so would provide additional air quality benefits and would ensure a level playing field for U.S. vessels. It would also avoid placing U.S. vessels with Category 1 and 2 engines at a competitive disadvantage.

We are not changing our approach for engines on foreign vessels at this time, and are deferring this decision to our Category 3 marine diesel engine rulemaking. This decision will not significantly affect the operating environment for vessels with Category 1 or Category 2 propulsion engines. Most of these vessels that are operated in the United States are flagged in the United States because they don't have the option of flagging offshore. This is because vessels engaged in harbor activities in U.S. ports or in transporting freight or otherwise operated only between two U.S. ports are subject to cabotage laws that require them to be flagged in the United States, as well as built in the U.S., owned and manned by U.S. citizens, and subject to all U.S. laws. Recent legislation addressed the special case of offshore platforms by specifying that trips to offshore platforms are considered to be between two U.S. ports. Other recent changes addressed anchor handling vessels as well. These laws do not prevent foreign vessels from operating in U.S. waters, although foreign vessels are required to obtain permission from the U.S. Customs. Permission can be obtained if the foreign operator can show there is no U.S. vessel available that can fill the need. So, exempting foreign vessels from the new Category 1 and 2 standards is not likely to increase the number of foreign vessels that can legally operate in the United States and therefore is not likely to have an impact on competition between these U.S. and foreign vessels.

With respect to Category 1 and 2 engines on ocean-going vessels, the standards are not expected to put an economic burden on U.S. vessels such that they are no longer able to compete with foreign vessels. Tier 3 engines will not be equipped with aftertreatment and the installation of these vessels will not lead to additional design costs. Therefore, we do not expect compliance with the Tier 3 standards to impose a competitive or economic disadvantage to U.S. vessels compared to foreign vessels. While the Tier 4 engines are expected to require SCR or PM aftertreatment, the additional costs associated with installing and operating these engines will be small compared to the total costs of building and operating an ocean-going vessel.

Postponing the decision of covering Category 1 and 2 engines on foreign vessels to our upcoming Category 3 marine diesel engine rulemaking, to be finalized by December 17, 2009, will allow us to assess the implications of applying EPA's standards on engines installed on foreign vessels in the context of the entire vessel and not just a vessel's auxiliary engines. It will also allow us to take into account the negotiations that are currently underway at the IMO to adopt a new set of emission limits for MARPOL Annex VI.[1] The air quality and competition impacts of deferring this decision to the Category 3 engine rulemaking are likely to be negligible.

3.2.4 Category 3 Marine Engines

What Commenters Said:

The proposed marine diesel engine standards covered only engines with per cylinder displacement below 30 liters. Several commenters encouraged EPA to also include standards for larger Category 3 engines. Some advocated adopting standards in this final rule; others recommended EPA pursue standards as soon as possible in a separate rule, or to coordinate with IMO. Many of these commenters indicated that they also commented on EPA's proposal to reset the regulatory deadline for the Category 3 marine engine rule to December 17, 2009.

Several commenters noted that Category 3 marine diesel engines are significant contributors to air quality in their areas. The North Kingston Community Association commented that shipping emissions in North America are on track to double in 10 years. SCAQMD noted that Category 3 marine engines are one of the largest under-regulated source categories of NOx emissions in the South Coast Air Basin and are expected to grow significantly to accommodate the tripling of the cargo throughput in local ports within the next 15 to 20 years. The Puget Sound Clean Air Agency stated that ocean-going vessels are responsible for over 56% of the marine-related diesel particulate emissions in the Puget Sound Maritime emission inventory study area, and 49% of the SO_2 emissions from marine-related sources. The commenter stated that, while it is encouraged by the recent U.S. position presented to the IMO, it also encourages EPA to move rapidly to produce similarly stringent U.S. rules for foreign-flagged Category 3 vessels entering U.S. waters, both to encourage IMO to act and to be ready to implement if IMO does not act expeditiously. Another commenter was concerned that if no aggressive emission reduction strategies are introduced, SO_2 emissions from ships could double present-day values by 2050, and smog-forming emissions could exceed those from present-day global road transport. The commenter further stated that CO_2 emissions from the shipping fleet are also expected to double in the next decade as fuel use soars with increased ship engine size and speed.

Some commenters noted that EPA delayed the promulgating standards for Category 3 engines while waiting for IMO to act (IMO has been considering revisions to the existing standards for NOx and SO_2 emissions from international shipping for the past few years), and urged EPA not to wait for IMO any longer. One commenter expressed concern that a delay by EPA only begets further IMO delay.

Other commenters recommended that EPA work through IMO to develop new stringent standards for these engines. BSL, on the other hand, recommended that that the issue of

1 See 72FR68518, December 5, 2007 for the new regulatory deadline for the final rule for an additional tier of standards for Category 3 rulemaking (final rule by December 17, 2009).

applying standards to engines on foreign vessels be addressed at IMO to ensure that reasonable international standards are applied to all vessels. OSG also commented that they support efforts to reduce emissions from ships and that working through IMO is the most effective means to reduce emissions from ocean going vessels. The commenter noted that it is a strong supporter of the INTERTANKO proposal to require the use of distillate fuel in any revision to the MARPOL.

Finally, at least one commenter recommended that before setting standards for ocean-going vessels more research is needed to accurately model thee emissions from vessels at sea.

Letters:
American Lung Association of the Northwest OAR-2003-0190-0482 (hearing)
Bollinger Shipyards Lockport, LLC (BSL) OAR-2003-0190-0520
City of Houston, Bureau of Air Quality Control (Houston BAQC) OAR-2003-0190-0561.1
Clean Air Task Force (CATF) OAR-2003-0190-0499 (hearing)
Crowley Maritime Corporation OAR-2003-0190-0641
Environmental Defense OAR-2003-0190-0487 (hearing), 0546 (hearing), 0592.1, 0638, 0610
Friends of the Earth OAR-2003-0190-0609
National Association of Clean Air Agencies (NACAA) OAR-2003-0190-0495, 0732
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0589.1
North Kingston Community Association OAR-2003-0190-0496 (hearing)
Overseas Shipholding Group, Inc. (OSG) OAR-2003-0190-0589.1
Offshore Marine Service Association (OMSA) OAR-2003-0190-0490 (hearing), 0611.1
Oregon Environmental Council (OEC) OAR-2003-0190-0652
Ozone Transport Commission (OTC) OAR-2003-0910-0633.1
Puget Sound Clean Air Agency OAR-2003-0190-0484 (hearing)
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0483 (hearing), 0558.1

Our Response:

Standards for Category 3 marine engines are not the subject of this rule. We did not propose, and we are not finalizing, any standards for them in this rulemaking. However, we acknowledge that these engines are significant contributors to national mobile source air inventories, and we remain committed to take action to reduce their emissions. One important action is our new rulemaking for a new tier of federal standards (see Advance Notice of Proposed Rulemaking published December 7, 2007 at 72 FR 69522). We have adopted a regulatory deadline of December 17, 2009, for the final rule for that rule. In addition, we continue to participate on the U.S. delegation to the International Maritime Organization for negotiations of new international standards and support the U.S. proposal for a comprehensive set of standards that will address both engine emissions and the fuels used in these vessels (see http://www.epa.gov/otaq/oceanvessels for a copy of the U.S. proposal). Finally, our Clean Ports

USA Initiative also provides a mechanism to reduce emissions from ocean-going vessels (see http://www.epa.gov/cleandiesel/ports/index.htm).

We note OSG's support for the INTERTANKO proposal at IMO.

3.2.5 Migratory Vessels

What Commenters Said:

Members of the offshore marine supply industry expressed concern about the impacts of the marine standards on their industry. They noted that they compete against foreign vessels in world markets for work in Central America, South America, West Africa, Asia, and the Persian Gulf. The Tier 4 standards would impact the ability of U.S. vessels to compete due to higher costs, and would reduce the flexibility of U.S. vessels to operate internationally due to the requirements for ULSD and urea. They requested that EPA not implement rules that restrict U.S. vessels to domestic markets, and recommended that requirements that apply to vessels that compete internationally be limited to the international standards, or at least represent the best available technology that is compatible with fuels available in foreign locales. Commenters stated that for Tier 4 standards to apply to engines on these so-called "migratory" vessels it is necessary to ensure that ULSD and urea are available outside U.S. ports.

Alternatively, to address the question of diesel fuel availability outside the U.S., some commenters requested EPA consider allowing emission controls and equipment to have the functionality to be turned on and off depending on the international area of operation. Such a by-pass would be permanently piped and allow selection by valve, and vessel operators could be required to log or report the use of the by-pass along with the location of the vessel at the time of the by-pass and the type of fuel being used. Others did not support this approach, including the engine manufacturers. One commenter noted that the operator will have no way to know when the fuel sulfur level in the vessel's tank has been diluted to an acceptable level to turn off the by-pass system, and another noted that fuel-tank draining and flushing would be unduly expensive and burdensome, and does not seem to be viable in practice. Also, the length of time that aftertreatment systems would remain idle raises many concerns.

EMA suggested an alternative approach where by after a specified date (e.g., 2025) fleet operators could petition the Administrator for approval to purchase a Tier 3 engine for a new migratory vessel provided that (1) the vessel will be operated substantially overseas, and (2) not less than 75 percent of the petitioner's fleet consists of Tier 4 vessels.

Caterpillar commented that a similar situation exists for recreational vessels. The commenter noted that many recreational vessels routinely fuel in ports outside the U.S., particularly in the Caribbean, and it is unlikely that these areas will have enough economic justification to install separate fueling infrastructure to handle ULSD for a small portion of their customers. The National Marine Manufacturers Association (NMMA) also recommended that recreational vessels not be required to meet the Tier 4 standards due to their operation abroad, noting that the few owners who flag in the United States would likely flag elsewhere both because of operating implications of aftertreatment systems and their impacts on resale values.

Letters:
Caterpillar, Inc. OAR-2003-0190-0591
Cummins, Inc. OAR-2003-0190-0599, 0653
Elliot Bay Design Group/Brian King, PE OAR-2003-0190-0486
Engine Manufacturers Association (EMA) OAR-2003-0190-0545, 0575, 0727
National Marine Manufactures Association (NMMA) OAR-2003-0190-0656
Offshore Marine Service Association (OMSA) OAR-2003-0190- 0490, 0611
Overseas Shipholding Group, Inc (OSG) OAR-2003-0190-0589
Passenger Vessel Association (PVA) OAR-2003-0190-0576
Tidewater Inc. (Tidewater) OAR-2003-0190-0557

Our Response:

In general, fleet owners or operators of most commercial vessels are expected to be able to comply with the marine diesel engine standards, either because they operate only in U.S. or foreign ports where ULSD is available, or because they can reorganize their business operations to use their fleet of vessels efficiently given fuel availability. Nevertheless, some commercial vessels are used in ways that could make the use of ULSD and even urea an intractable problem. These are commercial vessels that are routinely operated outside of the United States for extended periods of time, including tug/barge cargo vessels operated on circle routes between the United States and Latin America that routinely refuel in places where ULSD is not available, and lift boats, utility boats, supply boats and crewboats that are used in the offshore drilling industry and are contracted to work in waters off Latin America or Western Africa for up to several years at a time without returning to the United States. Owners of these vessels informed us that requiring them to use Tier 4 engines will adversely impact their business in significant ways since they would have to arrange for ULSD and urea outside the United States, potentially at great additional cost, and that this is turn would affect their ability to compete with foreign transportation providers who do not face the same costs. These owners flag their vessels in the U.S. to maximize the flexibility of their business operations, but they informed us that they would consider segregating their fleets and flagging some elsewhere if they are required to use Tier 4 engines. Similar to the recreational marine case, the engines on reflagged vessels would not be subject to any U.S. emission controls or compliance requirements. In addition, there could be adverse impacts on associated industries that use these services, if there are fewer vessels available for use in the United States. For all of these reasons, these vessel owner/operators encouraged EPA to consider a provision that would not require these vessels to use Tier 4 engines.

We do not expect ULSD availability at foreign commercial ports to be a widespread problem. Many industrial nations already have or are expected to shift to ULSD in the near future, including Japan (by 2008), Singapore (in 2007), Mexico (in 2007 for “Northern border areas”), the EU member states (by 2009), and Australia (by 2009). Other countries may also make ULSD available by 2016, as refineries in other countries modify their production to supply

ULSD to the U.S. markets even if they do not require it domestically. However, ULSD may be difficult to obtain in some areas of the world, notably Latin America and Africa. Therefore, it is reasonable to include a limited compliance exemption from the Tier 4 standards for the narrow set of vessels that are described above.

Because the decision of whether a Tier 4 engine is required must be made at the design phase of a vessel, and not after it goes into service, it is preferable to define such an exemption based on vessel design characteristics instead of the owner's intentions for how the vessel may ultimately be used. After consulting with industry representatives, we learned that the most obvious design feature that indicates the vessel is intended for extensive international use is compliance with international safety standards. Vessel owners indicated to EPA that the costs of obtaining and maintaining certification for SOLAS are high enough to discourage owners of vessels that will not be used outside the United States to obtain certification to evade the Tier 4 standards. These can range from about $250,000 to $1 million in capital costs and from about $50,000 to $100,000 in annual operating costs. The Port State Information Exchange database maintained by the USCG indicates that about 30 percent of offshore supply vessels built annually are SOLAS certified and that 3 percent or fewer passenger vessels and tugs built annually are SOLAS certified (based on new vessel construction, 1995-2006). Therefore, to be eligible for the exemption, the owner will be required to obtain and maintain relevant international safety certification pursuant to the requirements of the United States Coast Guard and SOLAS for the vessel on which an exempted engine is installed.

Vessel owners will be required to petition EPA for an exemption for a particular vessel in order for an engine manufacturer to sell them an exempted engine; granting of the exemption will not be automatic. In evaluating a request for a Tier 4 exemption, we will consider the owner's projections of how and where the vessel will be used and the availability of ULSD in those areas, as well as the mix of SOLAS and non-SOLAS vessels in the owner's current fleet and the extent to which those vessels are being or have been operated outside the United States. In general, it is our expectation that fleets should first use existing pre-Tier 4 vessels for operations were ULSD may not be available. Therefore, we would not expect to grant an exemption for a vessel that will be part of a fleet that does not already have a significant percentage of Tier 4 vessels, since a fleet with a smaller percentage of Tier 4 vessels would likely have more pre-Tier 4 vessels that could be employed in the overseas application instead. For example, if 30 percent of an owner's current fleet has SOLAS certification, we would expect that up to 70 percent of the vessels in that fleet could be Tier 4 compliant without changes in the operation of the fleet. We may also ask the petitioner to demonstrate that other vessels in the petitioner's fleet remain in service outside the United States and have not been placed into service domestically. We do not expect to approve applications for the Tier 4 exemption described in this paragraph prior to 2021; we expect that the existing fleet of Tier 3 vessels can be used for overseas operations during that time. If an owner petitions EPA for an exemption prior to that year, we may request additional information on the owner's expected operation plans for that vessel and a more complete explanation as to why another vessel in the existing fleet could not be redirected to the offshore application with the Tier 4 vessel under construction taking that vessel's place. Finally, a failure to maintain SOLAS certification for the vessel on which an exempted vessel is installed would result in a finding of noncompliance and the owner would be liable for applicable fines and other penalties.

While we are not in favor of a general by-pass option, it is reasonable to include a provision that would allow the use of a by-pass in certain situations. Specifically, to address the situation in which an owner of a vessel with Tier 4 engines wants to use that vessel in a country that does not have ULSD available, we are also including a provision that will allow the owner to petition EPA to temporarily remove or disable the Tier 4 controls on vessels that are operated solely outside the United States for a given period of time. The petitioner will need to specify where the vessel will operate, how long the vessel it will operate there, and why the owner will be unable to provide ULSD for the vessel. The petitioner will also be required to describe what actions will be taken to disable or disconnect the Tier 4 controls. Permission to disable or remove the Tier 4 controls will be allowed only for the period specified by the owner and agreed to by EPA; however, the owner may re-petition EPA at the end of that period for an extension. As part of the approval of such a petition, the petitioner will be required to agree to re-install or reconnect the Tier 4 emission control devices prior to re-entry into the United States, whether this occurs only at the end of the specified period or earlier.

We disagree with the assertion that it is not possible or practical for a vessel owner to drain the vessel's fuel tank in order to switch operation from temporary operation on high sulfur fuel with a by-pass to low sulfur fuel once the vessel returns to U.S. waters. While planned tank draining and turnover may be impractical to do as a regular part of vessel operation, doing so only when transitioning from extended operation on high sulfur is not unduly burdensome or expensive.

These provisions for migratory vessels are intended to facilitate the use of vessels certified to the U.S. federal marine diesel emission standards while they are operated for extended periods in areas that may not have ULSD available. It should be noted that vessels that receive either limited exemptions or that petition EPA to remove or disable Tier 4 controls will still be subject to the MARPOL emission limits when they are operated outside the United States. We may review these migratory vessel provisions in the context of our upcoming Category 3 marine diesel engine rulemaking. We may also revisit this program in the future if the number of exemption requests appears to be unreasonably high or if we find that significant numbers of vessels that have obtained exemptions from Tier 4 are, in fact, in use domestically.

With respect to recreational vessels that may operate outside the United States, we are not at this time applying Tier 4 standards to recreational vessel engines (see section 3.2.7 below). Therefore, ULSD availability is no longer an issue for them.

3.2.6 Engine Categorization and Cutpoints

What Commenters Said:

BAQC commented that it believes that the compliance date for the proposed standards should be based on the date the engine was built, not the date the vessel was built.

EMA commented that it believes that the NPRM appropriately creates an engine categorization scheme based on the three generic vessel applications, and so makes appropriate distinctions between recreational, small commercial, and large commercial marine engines. The commenter stated that it is necessary to take these three basic engine categories into account in determining the technology that can be applied to achieve maximum emission reductions, as each category has its own operational and design characteristics that are in fact fundamentally different. The commenter noted that the distinction between recreational and small and large commercial engines stems from the differences between recreational and commercial vessels. Recreational vessels utilize planing hulls and high-power density engines to bring the vessel up to plane, they are also are designed to be relatively light in weight and lack the dimensions, engine room space, and dry exhaust streams to accommodate exhaust aftertreatment systems. The commenter stated that the fundamental features of recreational vessels limit the deployment of advanced emission control technologies due to constraints on size and weight, the space available for aftertreatment and serviceability, and the operational duty cycle requirements—which necessitate the differing emission standards that are set forth in the proposed rulemaking.

EMA commented that it also believes that the NPRM appropriately categorized engines and standards based on power density - engine output per engine displacement. The commenter noted that the power density of an engine is directly related to its application; and generally, high-power density engines are used in recreational vessels and standard-power density engines are used in commercial vessels.

EMA commented that the bases for the distinctions and per-cylinder displacement cutpoints used by EPA in the 1999 Tier 2 rulemaking were not exact, and the distinctions were not completely clear. The commenter noted that currently there are more high-speed engine models (above approximately 1000 rpm rated speed) with displacement above 5 L/cyl in production or in development than there were in 1999, and these engines have more in common with the existing under 5 L/cyl engines than with the greater than 7 L/cyl engines. The commenter stated that it thus supports the change in the Category 2 cutpoint to 7 L/cyl. EMA stated that it also recognizes that starting with Tier 4, the differences in the emission limits on a liter per cylinder basis are eliminated, with rated power determining the emissions-related requirements. Additionally, EMA commented that it also supports the addition of a new cutpoint at 3.5 liters per cylinder. The commenter noted that this allows a phase-in of the emission standards so that not all engine models will need to be developed at the same time, as the limitations on engineering resources and on test cells makes it very difficult if not impossible to develop all engine models at the same time. The commenter also noted that nonroad engines will be going through their Tier 4 development in the same time period, thus the additional 3.5 L/cyl cutpoint allows for a more manageable phase-in of engines over time and will help to reduce the tremendous burden of developing low-emission marine ratings while at the same time working on Tier 4 nonroad applications. Indeed, a reasonable phase-in of the standards is essential to their feasibility.

EMA noted that there are several methods that could be used to segment the broad array of marine vessels impacted by the proposed rulemaking, such as: the existing USCG segmentation methods, vessel length, vessel hull type, engine power, engine displacement, and vessel application. EMA commented that, for the purpose of constructing a workable framework for this rulemaking, it is best to focus on three generic vessel applications - recreational vessels, small commercial vessels, and larger commercial vessels. The commenter noted that generally, the propulsion engines on recreational vessels are typically installed in confined spaces and have water injected into the exhaust stream downstream of the turbocharger, small commercial vessels (e.g., small fishing boats, military vessels, and small ferries) typically share those same installation characteristics. In contrast, EMA noted, propulsion engines used in large commercial vessels are more likely to be installed in larger engine rooms and use dry exhaust stacks.

EMA noted that the NPRM proposes the same emission limits and introduction dates for both propulsion and auxiliary engines within a given displacement range or power category, similar to the current Part 94 requirements; EMA commented that it fully supports this aspect of the proposed rulemaking. The commenter stated that marine engines generally employ the same design characteristics to allow their use in marine applications, regardless of whether the application is propulsion or auxiliary. The commenter noted that the marine engine market is a low-volume market when compared to the highway and nonroad engine markets, and marine engine designs are typically derivative of the engine designs used in those applications. The commenter further noted that within the low-volume marine market, the production of propulsion engines far outweighs that of auxiliary engines, thus auxiliary marine engines are typically derivatives of propulsion marine engines. Thus, EMA stated, it is not economically justifiable or feasible to develop unique marine engine designs solely for the auxiliary marine engine market.

EMD commented that it is common in the industry, particularly for larger engines, for manufacturers to use one basic power cylinder configuration and create models of differing output by incorporating differing numbers of cylinders. The commenter stated that the manner in which EPA has set standards cutpoints based both on engine power output and per-cylinder displacement for the emissions standards has sliced and diced the engine market in a manner very inconvenient for such manufacturers. The commenter noted that Figure 3 of EMD’s comments (OAR-2003-0190-0594.4) depicts the effect this has had on EMD Category 2 engines. The commenter provided the example that a Category 2 engine line with per-cylinder displacement above 15 liters, and eight-, twelve-, and sixteen-cylinder models ranging from 3000 to 6000 horsepower output will, in the years 2014 and 2015, be subject to three different sets of standards. EMD noted that these engines will have to belong to at least two (and probably three) different engine families, and will have to be the result of three different technical development efforts; and one engine family will require NOx aftertreatment two years before the other two will. The commenter stated that, in the absence of EPA’s standards structure, these three engines would benefit greatly from a common development effort, but the standards will make them three separate efforts, greatly increasing the effort and expense required of manufacturers. The commenter also stated that the effect of the effort and expense is exacerbated by the resulting engine configurations’ being marketable for only two years, providing only a very short period for cost recovery until a new Tier of standards becomes effective.

EMD also gave the example of an engine line with per-cylinder displacement less than 15 liters, but eight-, twelve-, sixteen-, and twenty-cylinder models ranging from 2000 to 5000 horsepower. The commenter noted the rule provision allowing the models with ratings below 3700 kW to harmonize with the standards for the locomotive engines from which they are derived; however, the twenty hp model is rated just above 3700 kW and is thus subject to a different set of standards and will require NOx aftertreatment two years before the other engines. The commenter noted that the standards currently in place (at 40 CFR Part 94) minimize this problem because it sets cutpoints based largely upon engine per-cylinder displacement, and has only three subcategories that would cover all locomotive-like engines. EMD noted that most engines with a common cylinder configuration would be subject to the same standards under this structure; the commenter advocated for a return to that structure in the new rule.

EMD urged EPA to simplify the cutpoint structure for Category 2 engines and structure the standards so that emissions limits are harmonized entirely with those for rail engines. EMD commented that it believes one step that would help this situation, but not necessarily ameliorate it entirely, would be to move the 15 L/cyl cutpoint to 17 liters (or perhaps, to eliminate it entirely) instituting rail-like standards for all engines between 7 and 20 L/cyl displacement.

Letters:
City of Houston, Bureau of Air Quality Control (Houston BAQC) OAR-2003-0190-0561.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1-0594.4
Engine Manufacturers Association (EMA) OAR-2003-0190-0545, 0503, 0575.1

Our Response:

We agree that the approach we have taken in setting these marine diesel standards results in a somewhat complicated array of emissions standards. However, we believe it is justified because it maximizes overall emission reductions by ensuring the most stringent standards feasible for a given group of marine engines. When combined with the implementation flexibilities we are providing, such as the averaging, banking, and trading credit program, we believe it also helps engine and vessel designers to implement the program in the most cost effective manner. Significantly, the changes we have made to the final Category 2 engine standards compared to the proposal allow for a better coordinated program across the range of large engines that EMD highlights. Furthermore, the option allowing engine designs derived from the locomotive sector to be sold in the marine sector provides another effective path to compliance across the relevant Category 2 engine range, and this option has been revised from the proposal concept to make it more flexible and useful to manufacturers, including a change allowing application across the broad Category 2 power band of 1400 kW and over. This addresses the problematic multiple design scenarios identified by EMD.

Regarding engine- vs vessel-based standards, our marine diesel standards do apply to engines on a model year basis. They also, in effect, apply to vessels built in a year that the standards are in effect, with an allowance to use up existing engine inventories when a new standard goes into effect, provided there is no stockpiling.

3.2.7 Recreational Vessel Engines

CARB noted that the NPRM indicates that catalytic exhaust treatment systems pose several significant packaging and weight challenges for vessels that use smaller engines. The commenter stated that it agrees that aftertreatment-based Tier 4 standards may not be appropriate for all categories of vessels, such as recreational and small commercial fishing vessels. The commenter noted that while the number of fishing vessels are large (about 75 percent of California's commercial harbor craft fleet), their contribution to the emissions inventory is relatively small (25 percent) and declining. Additionally, CARB commented that its survey of commercial harbor craft indicated that fishing vessels do not spend a significant portion of their operating time inside the harbor and so pose less of a concern for health risk.

NMMA commented that it strongly opposes Tier 4 standards for any class of vessel in the recreational marine sector. The commenter stated that it understood from the NPRM that EPA plans to impose Tier 4 catalyst-based requirements for boats with engines greater than 2000 kW flagged or registered in the U.S. NMMA commented that it is concerned this regulation will be ineffective and ultimately result in increased emissions, rather than reducing them. The commenter noted that, according to USCG data, less than 90 USCG documented vessels above 120 feet have a recreational boat endorsement. The commenter stated that the reason for this is that U.S. flagged vessels are required to carry certain insurance amounts, hire an American crew, and pay U.S. taxes. Conversely, the commenter noted, a boat registered in a Caribbean Island nation avoids these requirements, the only requirement is that the vessel document that it has left U.S. waters for one week per year. The commenter also noted that the taxes required to flag a U.S. vessel can run into the millions of dollars, whereas flagging a vessel outside the U.S. can be as low as a couple hundred dollars. The commenter stated that the rule will only serve to force the few patriotic citizens who currently flag their boats U.S. to move offshore where there are no emission requirements. NMMA commented that it fully supports Tier 3 standards for all compression-ignition powered recreational boats, regardless of size.

EMA commented that it does not support the application of Tier 4 standards to any recreational marine engines, regardless of their size. The commenter stated that it believes large recreational marine engines, such as those over 2000 kW, are installed in vessels that typically operate for relatively few hours per year, and routinely operate in foreign waters where ULSD and urea - the prerequisites for the anticipated Tier 4 aftertreatment technologies - will in all likelihood not be available. The commenter also noted that recreational vessels generally operate at low load factors, so their overall emissions contribution is very small. The commenter stated that, from a technical standpoint, it may be possible to fit aftertreatment systems in those few very large recreational vessels with engines having power ratings greater than 2000 kW. However, based on the testimony of recreational vessel manufacturers at the public hearings relating to this rulemaking, EMA commented that it believes that an aftertreatment requirement is likely to have a very substantial negative effect on the large recreational vessel market in the U.S. The commenter stated that the likely consequence of requiring aftertreatment would be to drive most of the new very large recreational vessels (of which there are very few to begin with) to flag outside of the U.S., resulting in the greater than 2000 kW recreational vessels being controlled only to IMO emission levels (and thus resulting in higher pollution than if the emission standards were kept at the still-stringent Tier 3 levels). EMA recommended that EPA adopt standards no more stringent than Tier 3 for all recreational marine vessels, regardless of their size.

MTU Detroit Diesel commented that, while it supports NMMA and EMA's comments regarding the possibility that vessel owners will simply register their vessels outside the U.S. if the Tier 4 aftertreatment-forcing standards were to be required on recreational engines greater than 2000 kW, it supports the 2000 kW limit for recreational vessels if the proposed Tier 4 emission limits are retained. The commenter stated that the proposal for recreational engines less than 2000 kW to be exempt from the Tier 4 regulations is an appropriate power limit. The commenter stated that analysis of the market reveals that all engines carrying a rated power of 2000 kW or less are operating in small volume sport fish, small performance, motor yacht hull designs—vessels in which there is insufficient room to add aftertreatment devices because the compartments in which the engines are housed are too small. The commenter noted that data shows that the majority of these vessels are operating with engines between 1000 kW and 1700 kW, and it is not foreseeable that the operators will be requiring any greater powered engines. It is MTU Detroit Diesel's anticipation that vessels operating with engines with a rated power greater than 2000 kW are equipped with large engine rooms and can handle the additional weight without affecting vessel performance, which are able to support the Tier 4 aftertreatment requirements. The commenter urged that any potential retention of aftertreatment forcing standards for recreational vessel engines should not apply to engines less than 2,000 kW as proposed in the NPRM. MTU Detroit Diesel stated that it supports the proposed requirement that engines greater than 2,000 kW for recreation follow the proposed Tier 4 standards.

Caterpillar commented that it believes that any requirement for aftertreatment should be eliminated completely for recreational vessels as the low volumes, relatively low load factors, and low annual hour accumulation in recreation applications simply do not justify the initial cost, added weight, and maintenance requirements for aftertreatment in these applications. Caterpillar requested that aftertreatment forcing standards not be applied to any recreational applications. The commenter noted that recreational vessels operate very limited hours over the year, and the emissions contribution is very small. Caterpillar commented that, even if applied only above 2000 kW, this requirement will have substantial detrimental affects on the large recreational vessel market without any reasonable emissions benefit. The commenter stated that aftertreatment requirements on recreational vessels will likely drive a substantial number of new builds to offshore flags; and in that case, these vessels could be powered with engines that have less stringent emissions than EPA Tier 2.

The Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, and Northwest District Association Health and Environment Committee commented that they believe recreational marine engines should be exempt from the rule, but noted that, as recreational engines are the least necessary, they are also the least deserving of exemption.

Letters:
California Air Resources Board (CARB) OAR-2003-0190-0596.1, 0719
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0591.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1
National Marine Manufacturers Association (NMMA) OAR-2003-0190-0513 (hearing), 0656
Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, Northwest District Association Health and Environment Committee OAR-2003-0190-0593.1

Our Response:

In response to the comments we received, we are not extending the Tier 4 program to recreational marine diesel engines. In our proposal we indicated that at least some recreational vessels, those with engines above 2000 kW (2760 hp), have the space and design layout conducive to aftertreatment-based controls and professional crews who oversee engine operation and maintenance. This suggested that aftertreatment-based standards would be feasible for these larger recreational engines. While commenters on the proposal did not disagree with these views, they pointed out these very large recreational vessels often travel outside the United States, and, for tax reasons, flag outside the U.S. as well. Commenters argued that applying Tier 4 standards to large recreational marine diesel engines would further discourage U.S.-flagging because vessels with those engines would be limited to using only those foreign ports that make ULSD and reductant for NOx aftertreatment available at recreational docking facilities, limiting their use and also hurting the vessel's resale value.

In general, we expect ULSD to become widely available worldwide, which would help reduce these concerns. However, there are areas such as Latin America and parts of the Caribbean that currently do not plan to require this fuel. Even in countries where ULSD is available for highway vehicles but not mandated for other mobile sources, recreational marinas may choose to not make ULSD and reductant available if demand is limited to a small number of vessels, especially if the storage and dispensing costs are high. To the extent the fuel requirements for Tier 4 engines encourage vessel owners to flag outside the United States, the results would be increased emissions since the international standards for these engines are equivalent to EPA's Tier 1 standards.

After considering the above, we conclude that it is preferable at this time to hold recreational engines marine diesel engines to the Tier 3 standards.

3.2.8 Multiple Engines

What Commenters Said:

EMA commented that it does not share EPA's concern that vessel builders may elect to install multiple smaller engines in new vessels in order to evade the 600kW cutpoint for Tier 4 engines. The commenter further stated that it does not believe that the potential problem is likely to occur to any significant extent. EMA commented that it strongly opposes the potential remedies that EPA has put forward to address what it believes is an unlikely scenario (72 FR 15978). The commenter stated that it believes that as long as the marginal cost of a Tier 4 engine (as compared with a Tier 3 engine) is not in excess of the cost of a Tier 3 engine, it is exceedingly unlikely that any vessel builders will choose multiple Tier 3 engine configurations where a single Tier 4 engine configuration would otherwise be sufficient. The commenter noted that the cost of fuel, if nothing else, makes it economically infeasible for a vessel builder to market a multi-engine configuration that is not actually necessary to perform the intended functions of the vessel. Additionally, the commenter noted that the use of multiple engines entails significant extra costs for multiple drive units, cooling pipes, heat exchangers, controls, and other essential accessories; thus putting a very practical and real limitation on the use of more than one engine solely to avoid the incremental costs of aftertreatment. EMA commented that, so long as EPA's cost estimates for this rulemaking are not off by more than a factor of four (72 FR 16018), the chances of vessel builders electing to go with multiple Tier 3 engines solely to evade the Tier 4 standards would seem to be quite remote.

EMA commented that, while it does not believe that the hypothetical problem at issue is likely to become a real concern, it is very concerned about the potential remedies that EPA has put forward. The commenter noted that the marine industry is highly non-integrated (i.e., marine engine manufacturers do not design or build marine vessels), so engine manufacturers simply do not know what specific type or size of vessels their engine products will end up going into nor do they know the specific work that a given new vessel may ultimately perform. The commenter thus stated that it believes that setting marine engine standards based on marine vessel characteristics is simply unworkable, and instead engine characteristics - those characteristics that are within the control of engine manufacturers - are what can and should determine whether Tier 4 standards should apply. The commenter noted that it is for these very reasons (and after due consideration of the make-up of the domestic fleet of commercial vessels) that engine power was relied on to set the proposed 600 kW cutpoint between the Tier 3 and Tier 4 standards.

EMA further commented that having one Tier 4 power cutpoint for single engine vessels (600 kW) and a different lower cutpoint (such as 550 kW) for multi-engine vessels is absolutely unacceptable to engine manufacturers. The commenter noted that such a requirement would mean that marine engine manufacturers would have to develop two product lines for all engine families that could cross into the lower cutpoint - one Tier 3 product line for single-engine vessels, and another Tier 4 product line for engines ordered for installation in multi-engine vessel. The commenter stated that product volumes are too low and manufacturing costs are too high to support any such regulatory scheme that would compel multiple product lines for the same types of marine engines. The commenter is concerned that such a requirement would have the practical effect of lowering the 600 kW cutpoint for the Tier 4 standards, which it stated is unacceptable to engine manufacturers. EMA commented that, since the hypothetical problem that EPA postulates is in all likelihood remote, and since the proposed remedies are inherently unworkable, the rule should not be changed to account for this issue. The commenter urged that the 600 kW cutpoint remain as the sole determinant of when the Tier 4 standards will apply under the final rule.

The New York State Department of Environmental Conservation noted that the NPRM requested comment on the regulation of vessels utilizing multiple engines. The commenter stated that it advocates the consolidation of marine diesel emission standards for all C1 and C2 marine engines above 100 hp into one set of emission standards. The commenter stated that all of these engines should be subject to Tier 4 standards, as this would eliminate much of the concern of the proposal encouraging the use of multiple engines to get around emission limits.

The U.S. Coast Guard commented that EPA is concerned that vessel owners might try to skirt around certain Tier 4 requirements by installing several smaller engines in lieu of one or two larger engines, and consequently requested comment on the notion of requiring vessel owners to submit plans to EPA for what (it believes) amounts to a limited vessel plan review of engine and power transmission. USCG noted that it has plan review authority over vessels and is concerned that this would require duplicative work by EPA, and unnecessarily complicate the plan review process for the U.S. marine industry. The commenter suggested that EPA consider as an alternative, an additional Tier 4 criteria of total installed power for a particular system. For example, there could be an additional total installed power limit of 1,200 kW for propulsion or electrical power generation utilizing more than one engine-- thus EPA could achieve its goal of ensuring that owners and operators are not skirting Tier 4 requirements by adding smaller engines that collectively produce more horsepower and greater emissions without adding unnecessary and costly duplicative federal government review.

Letters:
Engine Manufacturers Association (EMA) OAR-2003-0190-0545
New York State Department of Environmental Conservation OAR-2003-0190-0583.1
U.S. Coast Guard (USCG) OAR-2003-0190-0721

Our Response:

Our reconsideration of this issue based on comments we received leads us to conclude that multiple-engine configurations are used in vessel designs for specific purposes and are not likely to be employed to evade the Tier 4 standards. We may consider this type of restriction in a future action, however, if multiple-engine vessels are built in applications that have typically used a different number of engines in the past.

3.2.9 Residual Fuel Engines

What Commenters Said:

We proposed that engines designed to operate on residual fuel demonstrate compliance with the marine emission standards when operating on residual fuel. Several commenters raised questions about this approach. EMA, CIMAC Exhaust Emission Controls Working Group (CIMAC) and LCA expressed concern that residual fuel is not well defined in terms of fuel characteristics, and therefore it is not clear what fuel should be used for certification testing. CIMAC and LCA noted that the design principle of residual fuel Category 2 engines is different from similar distillate fuel engines, with the residual fuel engine associated with higher NOx and PM emissions. These commenters recommended that instead of the new Tier 3 and Tier 4 standards, EPA should adopt the IMO Annex VI standards for Category 2 residual fuel engines. They cautioned EPA that if residual fuel engines must meet the same standards as distillate engines, the result would be that no Category 2 engines will be certified for operation on residual fuel, and that U.S. ocean-going ships will consequently be put at a competitive disadvantage. LCA and Crowley also expressed concern that the new marine diesel engine standards would result in higher costs due to switching from residual fuel to distillate fuel and would encourage modal shifts (from ships to rail), with associated increases in fuel consumption and emissions. Finally, these commenters raised questions about how PM would be tested for engines operating on residual fuel. They noted that PM measurement method used for compliance testing, ISO 8178, does not accommodate the high sulfur levels of residual fuel. These commenters suggested that ISO 9096 should be used instead to achieve consistent measurement results and to allow comparison to land-based stationary sources.

In addition to the above, comments, Caterpillar commented that technology does not exist to bring the PM levels down to the Tier 3 or Tier 4 limits, due to the high sulfur and high ash content of heavy fuels. The commenter noted that the requirement for Category 2 residual fuel engines to be certified on residual fuel will give a competitive advantage to those engine manufacturers who have engine models that just exceed the 30 L/cyl cutoff for Category 2 engines, and suggested that EPA reconsider the upper threshold for Category 2 engines to address this concern. Caterpillar also noted several other consequences of restricting the use of residual fuel Category 2 engines, including: fewer engine repowers; modal shifting due to increase operating costs of using distillate; increased CO_2 emissions from use of more distillate fuel due to higher energy consumption at refineries to produce the ULSD for applications currently using heavy fuel.

CIMAC suggested that an alternative approach for controlling emissions from residual fuel engines would be to require them to use distillate while operating in U.S. waters, similar to the approach recently taken in California. Caterpillar suggested that fuel shifting from distillate to residual in response to a more relaxed approach to residual fuel engines could be reduced by limiting the use of residual fuel to engines greater than 2,000 hp and/or to vessels that exceed a given size or tonnage. Alternatively, the commenter suggested, residual fuel Category 2 engines should be included in the upcoming Category 3 marine diesel engine rulemaking.

One engine manufacturer (Cummins) supported the proposal that marine engines designed to operate on residual fuel, or fuels other than distillate, be required to meet the proposed standards while operating on those fuels. This commenter noted that providing an exemption would increase emissions, and that economic considerations could increase the number of vessels operating on residual fuel and give those vessels a competitive advantage over those that do not. The Puget Sound Clean Air Agency recommended that EPA not relax the standards to accommodate residual fuel engines, since this would result in higher emissions from auxiliary engines while they are in port. NESCAUM expressed its support for a distillate requirement for auxiliary engines, notwithstanding the need for a separate fueling system on the vessel.

<u>Letters:</u>
Caterpillar, Inc. OAR-2003-0190-0591
CIMAC Exhaust Emission Controls Working Group (CIMAC) OAR-2003-0190-0548
Crowley Maritime Corporation (Crowley) OAR-2003-0190-0641, 0659
Cummins, Inc. OAR-2003-0190-0599
Lake Carriers' Association (LCA) OAR-2003-1090-0567
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0512
Offshore Marine Service Association (OMSA) OAR-2003-0190-0490, 0611.1
Puget Sound Clean Air Agency OAR-2003-0190-0484

Our Response:

As we explained in the preamble to our NPRM, all of our mobile source emission control programs are predicated on an engine meeting the emission standards in use. We have a variety of provisions that help ensure this outcome, including specifying the useful life of an engine, specification of an emission deterioration factor, durability testing, and not-to-exceed zone requirements to ensure compliance over the range of operations an engine is likely to see in-use. These provisions are necessary to ensure that the emission reductions we expect from the emission limits actually occur. This means that an engine designed or intended to be operated on residual fuel would be tested on residual fuel.

We understand the commenters' concerns about the potential inability of Category 2 engines certified to the Tier 3 or Tier 4 standards on residual fuel. Our intention is not a de facto ban on residual fuel C2 engines. Our intention is that these engines achieve significant emission reductions to protect human health and welfare. The recommendations that we apply only the Annex VI NOx limits to Category 2 residual fuel engines or that we allow them to be tested on distillate fuel, are inappropriate because they do not achieve that goal. The Annex VI standards are equivalent to EPA's Tier 1 standards, for NOx emissions only, and do not reflect the emission reduction potential of advanced technologies. Testing on distillate fuel is also inappropriate. A distillate test approach was adopted in the NOx Technical Code because it was thought that the use of residual fuel would not affect NO_x, and the Annex VI standards are NO_x only. In addition, the NO_x Technical Code allows a ten percent allowance for in-use testing on residual fuel, to accommodate any marginal impact on NO_x and to accommodate adjustments that are necessary to test a residual fuel engine on distillate fuel. These adjustments were deemed necessary due to the different design principles for a residual fuel engine. But the consequence is that the actual emissions from the residual fuel engine when operated on residual fuel are uncertain. While this may be acceptable for a Tier 1 standard, it would not produce reliable emission reductions or demonstrate compliance with the Tier 3 and Tier 4 standards, which are for NOx and PM, in use. It should be noted while the Annex VI NO_x limits were expected to achieve a 30 percent reduction from uncontrolled levels for marine diesel engines, we estimate the actual reduction for residual fuel Category 3 engines to be closer to 20 percent, at least in part due to these testing issues (see 68 FR 9777, February 28, 2003). In addition, testing on distillate fuel would not provide a meaningful measure of PM emissions, since much of the PM emissions from residual fuel engines is from the sulfur in the fuel.

Nevertheless, to respond to manufacturer concerns about achieving the standards on residual fuel and to reduce concerns about the impact of the standards on engine availability, we asked for comment on a compliance flexibility consisting of an alternative PM standard and a tighter NOx standard. The alternative standards would be available for auxiliary engines to be installed on vessels with Category 3 propulsion engines. Certification testing would still be required on residual fuel, but we would allow alternative PM measurement procedures. To ensure that questions of test fuel and PM measurement are resolved before certification testing, manufacturers would have to apply to EPA to exercise this flexibility. We received no comments supporting the compliance flexibility described above, and therefore we are not adopting it.

With respect to test fuels, our current program specifies that if a Category 1 or Category 2 engine is designed to be capable of using a fuel other than, or in addition to, distillate fuel (e.g., natural gas, methanol, or nondistillate diesel, or a mixed fuel), exhaust emission testing must be performed using a commercially available fuel of that type. The current program specifies that the manufacturer is to set the test fuel specifications, with approval by us (40 CFR 94.108(b)(1)).

With respect to the comments on using ISO 8178 or ISO 9096, we are not changing our use of ISO 8178. With regard to the comment about this PM measurement being valid only for a fuel with sulfur content less than or equal to 8,000 ppm, this assertion is presumably based on ISO Section 3.1 Note 2 which states that “Particulate measurement as described in this part of ISO 8178 is conclusively proven to be effective for fuel sulfur levels up to 0.8 %.” It is important to note that this does not state that 8178 cannot be used for fuel sulfur levels above 0.8%. This ISO recommendation is based on work at fuel sulfur levels above 0.8% that did not maintain tight PM weigh room temperature and humidity control during PM mass analysis, contributing to large variability due to the varying amount of water bound to the sulfuric acid. In fact, ISO 8178 can be used at higher sulfur levels with appropriate testing conditions. ISO 9096, on the other hand, underestimates the contribution of condensable PM (sulfate and hydrocarbons) to the total PM by sampling the raw exhaust at elevated temperatures that do not represent the actual cooling and dilution that takes place when exhaust from marine engines enter into the atmosphere. Therefore, it is inappropriate for emissions testing for these mobile sources. It is also important to use ISO 8178 because marine engine emissions are categorized as mobile source emissions, and when determining mobile source PM inventory it is important that the PM emissions from these mobile sources are measured using the same methodology. There are also health effects associated with the condensable portion of PM, which makes its measurement essential to accurate quantification of PM emissions. Due to its inability to measure condensable PM, ISO 9096 is not a viable method for measurement of PM from mobile marine engines. There is no logical reason to sample PM from mobile marine engines using a stationary source methodology (ISO 9096), when the marine emissions are not considered part of the stationary source inventory. Further, even if some of the stationary source oil-fired power plants are identical in design to some mobile marine engines, the application of these engines is still different. If PM from marine engines is to be measured properly to compare to other mobile sources, the condensable fraction must be considered and ISO 8178 must be used.

With respect to the potential CO_2 consequences from the production of additional distillate fuel to be used in marine auxiliary engines instead of residual fuel, see response to 11.2.2.

In sum, we are not revising our program with respect to test fuels or the standards that apply to engines with per cylinder displacement below 30 liters that use residual fuel. However, as recommended by the engine manufacturers, we will revisit this issue in the context of our upcoming rulemaking for Category 3 marine diesel engines. We will include in our deliberations the suggestions from Caterpillar with regard to revising the upper threshold for Category 2 engines and alternative ways to limit the use of residual fuel engines in non-ocean-going vessels, as well as PM testing methods. We will also consider a geographic-based approach according to which engines on vessels operating along U.S. coasts and in our ports would use lower sulfur fuel.

3.2.10 Repowers

What Commenters Said:

Several commenters, expressed concern about the requirement that engines used to repower a vessel comply with the standards in effect at that the time the repower occurs. They noted that it may not be possible to fit a Tier 4 engine in an existing engine compartment. One commenter noted that the aftertreatment systems anticipated for Tier 4 engines, including DPFs, SCR systems, exhaust extensions and piping, as well as the necessary urea tanks and packaging equipment, cannot be retrofitted into existing vessels without incurring extreme and entirely disproportionate redesign and reconstruction costs. Cummins noted that a study by a naval architect, with EPA participation, concluded that adding retrofit aftertreatment systems or repowering with Tier 4 engines (with aftertreatment) would be extremely difficult, impractical, and not recommended. Some commenters noted that additional weight from these systems can result in substantial performance degrades such as trim, horsepower, revenue space and weight, shoreline erosion, and economic viability. Older vessels can be repowered with Tier 3 engines, on the other hand, because there would be no impact on the vessel in terms of additional equipment. In addition, a requirement to use a Tier 4 engine may discourage owners from repowering, resulting in greater emissions than if the engine was repowered with a Tier 3 engine. These commenters recommended that Tier 4 engines be required only for new builds, and that repowers not require Tier 4.

Another commenter asked EPA to clarify how the new program would apply to “swing” engines.” This commenter was concerned that many owners purchase spare engines at the time of vessel delivery to simplify engine maintenance. The commenter noted that these engines are stored onshore, and when engine maintenance is due or required, the swing engine is placed in the position of the engine requiring maintenance allowing the vessel a minimum of downtime. These owners are concerned about whether these swing engines would be rendered unusable at considerable capital cost.

EMA requested that EPA consider including a provision that would allow replacement of an engine with an identical engine in a repowering event if the warranty period for the original engine has not yet expired. This provision would allow engine manufacturers to address defective engines without having to provide an engine from a newer tier and provide a way to resolve customer satisfaction issues in the case of "lightly used" engines that may take years to accumulate enough hours for a problem to become apparent. EMA also requested that EPA revise the repower program to allow the engine manufacturer to make the determination of whether a newer tier engine can be used as a repower instead of EPA, due to time considerations. EMA noted that EPA has already agreed to such an approach for catastrophic failures.

Several commenters requested that EPA clarify the process for obtaining a previous model year engine, to avoid engine mismatches on a vessel for example. Commenters also suggested that the determination consider ancillary equipment as well as restrictions on the engine itself. Commenters also opposed the provision requiring EPA to make the determination that no certified engine is available when an engine is replaced.

Letters:
American Waterways Operators (AWO) OAR-2003-0190-0519 (hearing), 0574.1
Bollinger Shipyards Lockport LLC (BSL) OAR-2003-0190-0520
Cummins, Inc. OAR-2003-0190-0599, 0653
Elliot Bay Design Group/Brian King, PE OAR-2003-0190-0486
Engine Manufacturers Association (EMA) OAR-2003-0190-0575
Lake Carriers' Association (LCA) OAR-2003-0190-0567
Marathon Petroleum Company LLC (Marathon) OAR-2003-0190-0595
Offshore Marine Service Association (OMSA) OAR-2003-0190- 0490, 0611
Overseas Shipholding Group, Inc (OSG) OAR-2003-0190-0589
Passenger Vessel Association (PVA) OAR-2003-0190-0576
Tidewater, Inc. OAR-2003-0190-0557
U.S. Department of Homeland Security, United States Coast Guard (USCG) OAR-2003-0190-0721

Our Response:

We made several changes to our provisions for engine repowers and retrofits in response to the above comments.

First, engine manufacturers may now make the determination with respect to the feasibility of using a current tier engine in both noncatastrophic and catastrophic situations, provided certain additional conditions are met: the engine manufacturer must examine the suitability of replacement with any current tier engine, either produced by that manufacturer or any other manufacturer; the engine manufacturer must make a record of each determination, which must be kept for eight years and contain specific information; the record must be submitted to EPA within 30 days after shipping each engine along with a statement certifying that the information contained in that record is true. We may reduce the reporting and recordkeeping requirements in this section after a manufacturer has established a consistent level of compliance with the requirements of this section. These records will be used by EPA to evaluate whether engine manufacturers are properly making the feasibility determination and applying the replacement engine provisions. We may void any exemptions we determine do not conform to the applicable requirements. When assessing penalties under this provision we would consider whether the manufacturer acted in good faith. Thus manufacturers are encouraged to keep additional records to support their good faith attempt to comply with the regulations. For example, manufacturers could keep records of requests for replacement engines that are denied.

In making the determination that a current tier engine is not a feasible replacement engine for a vessel, we expect the engine manufacturer will evaluate not just engine dimensions and weight, but may also include other pertinent vessel characteristics. These pertinent characteristics would include downstream vessel components such as drive shafts, reduction gears, cooling systems, exhaust and ventilation systems, and propeller shafts; electrical systems for diesel generators (indirect drive engines); and such other ancillary systems and vessel equipment that would affect the choice of an engine. At the same time, there are differences between the new tier and original tier engines that should not affect this determination, such as the warranty period or life expectancy of a newer tier engine, or its cost or production lead time. These characteristics should not be part of the determination of whether or not a new tier engine can be used as a replacement engine. With regard to the warranty period or life expectancy for the new tier engine, an exception may be if these are significantly shorter for the new tier engine than for an older tier engine or the original engine and the shorter warranty period or life expectancy for the newer model is consistent with industry practices.

In addition, in the case of a vessel with two or more paired engines, if the engine not in need of replacement has accumulated service in excess of 75 percent of its useful life we specify that the determination must consider replacement of both engines in the pair. This requirement is necessary to prevent circumvention of the new engine requirements by replacing one engine at a time and relying on the need to pair the engines as the sole justification for producing an engine to an earlier tier. We are also specifying that no additional modifications may be made to a vessel for six months after installing a new replacement engine made to a previous tier. This is to avoid circumvention of the requirement to use a new engine when a vessel is refurbished such that it becomes a new vessel.

Second, we are revising the program to specify that the engine manufacturer must consider all previous tiers of standards and use any of their own engine models from the most recent tier that meets the vessel’s physical and performance requirements. This will ensure that the best control technology that fits the vessel is used.

The third change to the replacement engine provisions pertains to Tier 4 engines. We are making the advance determination that Tier 4 engines equipped with aftertreatment technology to control either NOx or PM are not required for use as replacement engines for engines from previous tiers in accordance with this regulatory replacement engine provision. Note, however, that Tier 4 engines will be required to be used as replacement engines if the original engine being replaced is a Tier 4 engine. We are making this determination in advance because we expect that installing such a Tier 4 engine in a vessel that was originally designed and built with a previous tier engine could require extensive vessel modifications (e.g., addition of a urea tank and associated plumbing; extra room for a SCR or PM filter; additional control equipment) that may affect important vessel characteristics (e.g., vessel stability). It should be noted that by making this advance determination, EPA is not implying that Tier 4 engines are never appropriate for use as replacement engines for engines from previous tiers; this determination is intended to simplify the search across engines and is based on the presumption that Tier 4 engines may not fit in most cases. We are also not intending to prevent states or local entities from including Tier 4 engines in incentive programs that encourage vessel owners to replace previous tier existing engines with new Tier 4 engines or to retrofit control technologies on existing engines, since those incentive programs often are designed to offset some of the costs of installing and/or using advanced emission control technology solutions. This advance determination is being made solely for Tier 4 marine diesel replacement engines that comply with the Tier 4 standards through the use of catalytic aftertreatment systems. Should an engine manufacturer develop a Tier 4 compliant engine solution that does not require the use of such technology, then this automatic determination will not apply. Instead, our existing provision will apply and it will be necessary to show that a non-catalytic Tier 4 engine would not meet the required physical or performance needs of the vessel.

In response to those who requested we explain the process better, if a vessel owner wants to repower with a new engine, they need to purchase an engine that is certified to the emission standards that apply to new engines for the model year during which they are manufactured. This is due to regulatory provisions applicable to engine manufacturers that prohibit them from manufacturing engines that don't meet the emission standards once the standards are in effect.

However, an exception to this provision is allowed. If the engine manufacturer does not produce an engine certified to current emission standards that has the appropriate physical or performance characteristics necessary to repower the owner's vessel, the engine manufacturer can demonstrate this case to EPA and request approval to produce a new engine certified to a previous tier of emission standards or an uncertified engine. In circumstances where a new engine is needed to replace an engine that has experienced catastrophic failure (i.e., the vessel is no longer operable), the engine manufacturer can make this determination without prior EPA approval in order to reduce the amount of time in returning the vessel to service. In this latter case, the engine manufacturer is required to maintain records of these determinations.

For clarification, it is necessary to obtain prior EPA approval for use of this exception for situations such as a planned repower. In those cases, the engine is typically being exchanged for a more advanced, fuel efficient engine. In cases where the owner wants to use the same engine, there should be ample time in the planning process to allow for the engine manufacturer to certify the engine accordingly.

It should be noted that even if an owner can show a need for a prior tier engine, it will still be necessary for the engine manufacturer to make the engine. We expect these engines will become more expensive over time, making this option less attractive.

With respect to "swing" engines, owners of some marine fleets maintain a readily available "pool" of rebuilt or remanufactured engines to allow for efficient replacement of engines from within the fleet in need of rebuilding. This process, which utilizes engines commonly called "swing" engines, involves removal of the engine from the vessel and replacement with an engine from the pool. The engine that has been removed is then rebuilt and returned to the engine pool for later use as a replacement engine. This process allows fleet owners to minimize vessel down-time since swapping takes less time than rebuilding in place, and allows them more time for the rebuild.

Our regulation does not prevent this practice. However, it is necessary to ensure that any replacement engine installed in a vessel is certified to the same emission standards as the engine it is replacing. For example, Tier 2 engines installed in a vessel built after the Tier 2 standards effective date may only be replaced with engines that also meet Tier 2 standards. Vessel owners are not allowed to install Tier 1 or earlier engines in such a vessel. This will require vessel owners maintaining engine pools to segregate their engines according to the emission standards to which they are certified. It is likely the case that vessel owners already follow this practice due to the differing physical and/or performance characteristics of the engines certified to different emission standards, especially for vessels with paired engines.

In addition to the above, some rebuilt engines may be subject to our special provisions for remanufactured engines outlined in Subpart J. If Subpart J is applicable to a remanufactured engine and a remanufacture system is available, vessel owners must utilize the remanufacture system at the time of remanufacture. The same logic as outlined above would apply when utilizing a remanufactured engine from an engine pool. For example, Tier 2 engines installed in a vessel built after the Tier 2 standards effective date may only be replaced with engines that meet the remanufacture standards applicable to Tier 2 engines. Vessel owners are not allowed to install engines in such a vessel that meet the remanufacture standards applicable to Tier 1 or earlier engines.

Finally, we have considered but rejected the suggestion that the program allow a replacement to be of the same tier, even if a newer tier engine will fit, if the engine warranty period has not expired. Our concern is that an engine under warranty can have up to five years of service remaining, which means the engine could be at least one tier and as many as two tiers old. Allowing an automatic exemption if the engine is still under warranty is unreasonable given the fact that there are other provisions in the program that would allow the engine manufacture to take alternative action. Specifically, if the engine is still under warranty, the manufacturer may rebuild it to its original configuration or replace it with a new engine certified to the current tier, to maintain customer satisfaction. Alternatively, the manufacturer could apply for an uncertified replacement engine exemption, if the characteristics of the engine are such that a new tier engine won't fit.

3.2.11 Engines Sold To Both Locomotive and Marine Markets

What Commenters Said:

Regarding EPA's request for comments on the proposal to provide an option of allowing marine engines in the 1400-3700 kW range to meet Tier 4 emission standards on a similar schedule as the locomotive schedule, Caterpillar noted that the Tier 4 PM level would be implemented in 2015 and the NOx level in 2017. The commenter further noted that this option would allow the manufacturers whose larger market is locomotive to develop locomotive and marine engines and aftertreatment on the same schedules. The commenter does not agree that implementing PM aftertreatment first followed by NOx aftertreatment makes sense from a technology availability standpoint. Caterpillar noted that particulate aftertreatment for marine applications and for locomotives has far more uncertainty than NOx aftertreatment, which is considered to be SCR. However, the commenter stated that it is not opposed to allowing the locomotive schedule as an option for marine if competitive issues are adequately addressed; if the competitive issues are not addressed, the commenter noted, this option would result in a disadvantage for manufacturers of engines whose primary market is not U.S. locomotives. Caterpillar commented that it believes that the option of allowing marine Tier 4 phase-in for PM and NOx on a similar schedule to locomotives should only be provided if the locomotive application allows a phase-in that permits meeting the NOx aftertreatment forcing standards first followed by the PM forcing standards, corresponding to Tier 4 NOx levels in 2015 with final Tier 4 PM in 2017 based on the current locomotive rule proposal.

Caterpillar commented that it believes the limitation in the proposed rule allowing this option only for engines less than 15 L/cyl is completely unacceptable from a competitive impact standpoint. The commenter further stated that the preamble note limiting the option to 7-15 L/cyl is even less acceptable. The commenter stated that no limitations on displacement/cylinder should be included in the option. Caterpillar stated that it is concerned that the proposed 1400 kW power level may be too low as it could introduce significant competitive issues for smaller engine manufacturers. EMA offered very similar comments.

EMD noted that many, if not most, Category 2 engines are derivatives of rail engines. Regarding EPA's request for comment on whether a provision is needed in order to avoid designing engines specifically for the marine market, EMD commented that it enthusiastically supports harmonization of Category 2 marine engine standards with those for the locomotive engines from which they are derived. The commenter noted that locomotives comprise about 95 percent of the market for engines of this size (with marine engines making up most of the remaining five percent), and stated that it makes poor economic sense to design engines specifically for such a small market segment. With this, the commenter noted that the restriction of "locomotive-like" engines to the 7 to 15 L/cyl size range implied by EPA excludes some of the newer engines. The commenter noted examples of engines with per-cylinder displacements above 15 L/cyl that are primarily locomotive engines but are also sold into marine service. The commenter stated that it is therefore desirable to harmonize Category 2 marine standards with locomotive standards not only for those below 15 L/cyl, but for some of those above as well.

GE commented that it believes that engines over 3700 kW maximum power rating that are primarily used in locomotive applications and adapted for use in marine applications should be regulated to the Part 1033 Tier 4 timeline for all emission levels. The commenter stated that the primary reason for this recommendation is that pursuing an accelerated development effort that would have to introduce advanced NOx aftertreatment technology for the same engine approximately 3 years before it will be ready for introduction on a locomotive simultaneously with the development and implementation of an advanced PM aftertreatment system would be virtually impossible. The commenter stated that, by allowing manufacturers of dual-use engines with the primary use being locomotives to comply with Part 1042 Tier 4 emissions levels in accordance with the timeline specified in Part 1033 Tier 4, EPA will enable manufacturers to make the most effective use of their own resources and aftertreatment manufacturers' resources in developing and implementing these advanced technologies. The commenter stated that, given the relatively small sales volumes of these engines, the emissions impact would be minimal; and despite the delay in achieving the Part 1042 Tier 4 NOx reductions, it would actually result in an early realization of the Part 1042 Tier 4 PM reductions.

<u>Letters:</u>
Caterpillar Inc. OAR-2003-0190-0485, 0498, 0580.1, 0591.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0545, 0503, 0575.1
General Electric Transportation Systems (GE) OAR-2003-0190-0590.1

Our Response:

As explained in section III of the preamble to the final rule, we proposed an option allowing large marine engines to meet a Tier 4 schedule coordinated with the locomotive program schedule. We have revised this option from the proposal concept in response to comments we received. The Tier 4 standards for locomotives and for C2 diesel marine engines of comparable size are at the same numerical levels but differ somewhat in implementation schedule: locomotive Tier 4 starts in 2015, and diesel marine Tier 4 starts in 2016 for engines in the 1400-2000 kW (1900-2700 hp) range, and in 2014 for engines over 2000 kW (with final PM standards starting in 2016 for these engines). We consider these locomotive and marine diesel Tier 4 implementation schedules to be close enough to warrant our adopting a marine engine option based on the Tier 4 locomotive schedule, aimed at facilitating continuance of today's frequent practice of developing a common engine platform for both markets.

Commenters supported this concept, but expressed concerns about competitiveness issues and argued that we should remove the proposed restriction to engines of 7-15 liter/cylinder displacement and under 3700 kW maximum engine power. We are adopting this option, but with some changes from the proposed approach to address potential competitiveness issues, as well as our own concern that this option be used only for the intended purpose of avoiding unnecessary dual design efforts. First, we are retaining some limits on its scope, specifically to engines above both a 7 liters per cylinder limit (Category 2 in the marine sector) and a 1400 kW (1900 hp) maximum engine power. Second, if the option is used, its standards must be met for all of a manufacturer's marine engines at or above 1400 kW (1900 hp) in the same displacement category (that is, 7-15, 15-20, 20-25, or 25-30 liters per cylinder) in all of the model years 2012 through 2016. This will help ensure the option is not gamed by artificially subdividing engine platforms. Because the switch locomotive program we are establishing already includes a similar streamlined option allowing the use of land-based nonroad engines, we are not extending this option to switchers.

We are adopting another provision to help ensure that this option is environmentally beneficial and is not used to gain a competitive advantage. We are requiring that marine engines under this option meet Tier 3 standards in 2012, the year Tier 3 starts for locomotives, with standards numerically corresponding to locomotive Tier 3 standards levels: 0.14 g/kW-hr (0.10 g/bhp-hr) PM and 7.8 g/kW-hr NOx+HC (5.8 g/bhp-hr: that is, 5.5 + 0.30 g/bhp-hr combined NOx and HC). Otherwise a manufacturer could take advantage of the later-starting marine Tier 3 schedule to generate credits or allow increased emissions from these engines until 2015 when the option requires Tier 4 compliance.

3.2.12 Refurbishing

What Commenters Said:

Marathon noted an error in the equation of the Percent of Value formula to determine if a vessel is considered "new" after a modification.

<u>Letters:</u>
Marathon Petroleum Company LLC (Marathon) OAR-2003-0190-0595

Our Response:

With respect to the comment about the value formula to determine if a vessel is considered "new" after a modification, the proposed equation in §1042.801 for defining when a modified vessel becomes new was misprinted by the Federal Register. We will adopt the final rule with the correct equation as shown below. Verifying this led us to realize that the equation in part 94 is also incorrectly published, which we are revising to read as follows:

Percent of value = [(Value after modification)-(Value before modification)] × 100% / (Value after modification)

If the value of the modifications exceeds 50 percent of the final value of the modified vessel, we would treat the vessel as new. To evaluate whether the modified vessel would be considered new, one would need to project the fair market value of the modified vessel based on an objective assessment, such as an appraisal for insurance or financing purposes, or some other third-party analysis. While the preliminary decision can be based on the projected value of the modified vessel, the decision must also be valid when basing the calculations on the actual assessed value of the vessel after modifications are complete.

The above generally applies in the case of existing vessels that are being modified to improve/alter the functional capacity of the vessel and/or extend its life. In the case of salvaged vessels, the intent is usually to return the damaged vessel back to an operable condition. In EPA's experience with salvaged vessels, most insurance estimates show that the value of the repaired vessel is equivalent to the value of the pre-damage vessel. Thus, only in circumstances where the vessel owner makes additional modifications/improvements to the vessel other than repair would EPA expect you to consider whether the vessel becomes a “new vessel” for the purpose of determining what model year engines are required for the vessel. If the vessel is only being returned to its operable state, the replacement engines merely need to be certified to the applicable model year emission standards for the year in which they were manufactured.

In the case of temporary modifications, these would not be considered to be vessel refurbishing for the purpose of the “new vessel” definition. We are defining temporary modifications as modifications to a vessel that are made pursuant to a written contract between the vessel owners and the purchaser of the vessel’s services and that are made for the purpose of fulfilling the purchaser’s marine service requirements. To be considered to be temporary, the modifications must be removed from the vessel upon expiration of the contract or after a period of one year, whichever is shorter. While we will allow a vessel owner to petition EPA for a longer period of time, we will generally assume that changes that are necessary for longer than one year are quasi-permanent. We do not expect there to be many petitions for longer periods of time because temporary modifications that exceed 50 percent of the vessel’s value would be considerable and would likely involve the vessel’s power plant.

3.2.13 Stakeholder Outreach

What Commenters Said:

EMA commented that it is generally concerned that the Tier 4 requirements for aftertreatment and the resultant effects on vessel designs and operations have not been vetted adequately with marine classification societies, vessel operators, and/or the USCG. The commenter stated that, based on comments made at the public hearings in Seattle and Chicago, as well as considering EMA’s own outreach efforts to the marine community, it appears that much more involvement and interaction with the other key stakeholder groups should be undertaken before the rule is finalized. EMA noted that while its members have tremendous expertise in engine design, emission control technology, and marine engine applications, they do not have the in-depth knowledge of all the aspects of marine applications that the Coast Guard, marine societies, vessel designers, vessel builders, and vessel operators have. EMA thus stated that it strongly recommends more direct involvement with those groups to gain greater appreciation of the consequences of the proposed rule.

Letters:
Engine Manufacturers Association (EMA) OAR-2003-0190-0545, 0503, 0575.1

Our Response:

We have had extensive involvement from Coast Guard, marine classification societies, vessel designers, vessel builders, and vessel operators throughout this rulemaking. They have been very helpful in informing the rulemaking process and in ensuring a quality result. See the rulemaking docket EPA-HQ-2003-0190 for a complete listing of these meetings and the detailed comments these stakeholders have submitted.

3.2.14 Other Marine Issues

What Commenters Said:

The Southwest Clean Air Agency commented that it advocates new rule language requiring that locomotives and marine diesel engines traveling through federally designated National Scenic Areas, Class 1 areas, and major metropolitan areas be designated for first application of remanufactured and newly-built locomotives and marine diesel engines meeting the new standards.

Tidewater noted that it posed the question to EPA regarding the possibility for future use of the technology associated with liquefied natural gas (LNG) engines. The commenter noted that currently the Norwegians have two experimental off-shore vessels (OSV) designed for LNG, and they are building ferries powered by LNG engines. The commenter also noted that, according to recent trade press articles, when their LNG engines are compared to conventional diesel engines, CO_2 emissions are reduced approximately 20 percent, NOx emissions are reduced about 90 percent, and SOx emissions are virtually zero. The commenter stated that Norway's exploration of LNG as a fuel source was driven in large part by the ready availability of LNG product from their offshore production fields, which has the benefit of avoiding wasteful flaring or the need for pumping gas back into the wells. The commenter stated that OSVs operate in similar close proximity to such fields all over the world and that this would be an ideal option if the technology is proven, but the NPRM gives no options for technologies that are not presently developed.

Tidewater commented that it had hoped that there might be some discussion of overall relative efficiencies between the various methods of vessel propulsion. The commenter stated that the rulemaking would benefit from a frank discussion that could give guidance in engine and propulsion selections for better efficiencies and cleaner operation. Tidewater commented that it believes that marine transportation is already the most efficient means of transporting goods, but there are many equipment and propulsion options that affect overall efficiency of the vessels. Additionally, the commenter noted that vessels are often over-powered for specific operations that may only make up a small percentage of a vessels service life (e.g., ice class vessels and anchor handling vessels, which typically have significantly more power than is needed for routine operations). The commenter noted that there is no accommodation given in the NPRM for overall efficient or average use of power, rather the NPRM only appears to consider full power and will have a significant impact for over-managing emissions.

<u>Letters:</u>

Southwest Clean Air Agency	OAR-2003-0190-0468, 0508 (hearing)
Tidewater Inc.	OAR-2003-0190-0557.1

Our Response:

Regarding comments on marine diesel vessels traveling through federally designated National Scenic Areas, Class 1 areas, and major metropolitan areas, see our response to comments in section 3.1.5, “National Scenic Areas”.

We note Tidewater’s interest in having an emissions program that accounts for efficiency differences between engine types. We welcome ideas to encourage the use of design and operational measures that, while aimed at improving efficiency, also produce real, calculable reductions in regulated pollutant emissions. See, for example, the measures adopted in this rulemaking for crediting of this sort in the locomotive sector (preamble section III.B(7)). We note too that engine-based measures to improve efficiency that do so by improving the engine’s brake-specific fuel consumption are already credited in the form of the standard (g/kW-hr) and test procedure. We did not propose however, and are not finalizing, additional provisions of this sort for marine engines in this rulemaking.

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4 CERTIFICATION AND COMPLIANCE PROGRAM

What We Proposed:

The comments in this section correspond mainly to Section IV of the preamble to the proposed rule, and are therefore targeted at certification and compliance. A summary of the comments received, as well as our response to those comments, are located below.

4.1 1068 and General Compliance Provisions

4.1.1 Production Line Testing (PLT) and Selective Enforcement Audit (SEA)

4.1.1.1 General

What Commenters Said:

The Engine Manufacturers Association (EMA) commented that it has been engine manufacturers' experience that the cost of the production line testing (PLT) program far outweighs any potential benefits; the commenter recommended that the PLT program be eliminated completely for marine engines. The commenter stated that certification testing is extremely expensive, and certification test cell resources are extremely limited and should be utilized for new product development (including emission reduction programs) rather than a quality control program. The commenter also noted that for compression ignition (CI) engines, PLT requirements are found only in the locomotive and marine regulations. EMA noted that its members have compiled the costs associated with the PLT program and found that those costs exceeded $620,000 in 2006 (based on 92 PLT audits involving more than 144 test cell days), with a net result of one (1) PLT 'failure,' which was readily addressed. EMA commented that if EPA does not eliminate the PLT program for marine engines, it believes that EPA should provide a detailed cost-benefit analysis of such a program. Additionally, EMA commented that if EPA does not eliminate the program, a more cost-effective program, one similar to that proposed by EMA during the rulemaking development, should be adopted. They also offered a specific recommendation for a lower testing rate. EMA also offered additional factors which it believes support the elimination of the PLT program, including: that the marine rule contains selective enforcement audit (SEA) provisions, that the vast majority of marine engine families are derivatives of other higher volume engine families which have manufacturer self-audit programs, and that CI engines are often tested at a rate of 100 percent to assure basic engine performance characteristics.

Manufacturers also commented that the requirements of PLT and in-use testing are currently large and growing burdens for locomotive certification. The commenter stated that it believes that these requirements should be eliminated on all switcher locomotives, not just those that use non-road certified engine configurations. Without this change, the commenter stated, engines developed for locomotive switching operations will be discouraged in favor of switchers using nonroad cycle-certified engines. The commenter further noted that PLT burden could lead to switcher engine and locomotive manufacturers avoiding the route of developing engine and control systems truly optimized for locomotive use.

Electro-Motive Diesel, Inc. (EMD) noted that in the formation of Part 92 in the original locomotive rule, industry urged EPA not to implement selective enforcement audits (SEAs), and EPA listened and understood. The commenter stated that it believes that an SEA program is not necessary for locomotives, and it is concerned that EPA has proposed an SEA program for the Tier 4 program.

The Association of American Railroads (AAR) commented that it objects to EPA's apparent proposal to expand the production line testing (PLT) program to include non-certifying railroads.

Letters:
Association of American Railroads (AAR) OAR-2003-0190-0566.1
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0591.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502 (hearing), 0505, 0594.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

We believe that some testing of production engines is generally required to ensure that engines are being produced consistent with the certificate of conformity. It does no good to require a manufacturer to certify an engine design for an engine family, if the engines do not conform to that certificate when they are produced. In the past, we have relied on SEAs to ensure production quality. In the SEA program, EPA audits the emissions of new production engines by requiring manufacturers to test engines pulled off the production line on short notice. This spot checking approach relies largely on a deterrence strategy. We now believe that a PLT program is generally more effective, and less burdensome than frequent SEAs. Manufacturers already design into their production processes steps necessary to make sure their engines are properly produced. Emission testing can generally be designed into that process with limited burdens. Thus, we disagree with the comments suggesting that PLT is not necessary or that it is excessively burdensome. We also do not agree that a one percent testing rate is too high. Since we are not changing the default PLT programs for either locomotives or marine engines from those already existing, we see no basis for conducting a detailed cost benefit analysis.

Just as with the regulations in Parts 92 and 94, we have included in Parts 1033 and 1042 specific authority to allow manufacturers to develop their own methods of ensuring that the engines are being produced to comply with the emission standards. Thus, while we disagree with manufacturers claiming the program is too burdensome, we allow them to develop less burdensome alternatives. To help them reduce their burden, we are adopting a specific alternative that would allow them to use field-grade measurement systems with a slightly higher sampling rate. Under this option, manufacturers would be required to double their initial sampling rate. The number of additional engines that would need to be tested for each test failure would be the same as in the main program.

We disagree with manufacturers that switchers should be subject to less compliance testing than line-haul locomotives to incentivise their certification as locomotives. We believe that manufacturers will choose the interim nonroad engine certification route unless the customer demands Part 1033 locomotive certification. Thus we do not believe that incentive or disincentives for the engine manufacturer will be of primary importance.

We are modifying the regulatory text of §1033.601 to be clear that the SEA provisions of Part 1068 do not apply for locomotives. This is to be consistent with the approach adopted in Part 92, which did not subject locomotives to SEAs.

In response to AAR's comment, we are changing the example in §1033.1, which could have been read to imply that non-certifying railroads are required to perform production-line testing. That was not our intent.

4.1.1.2 Engine and Catalyst Stabilization

What Commenters Said:

EMD commented that it believes that EPA's proposed provision that the final test result from multiple tests on a PLT locomotive or marine engine should be the average of all of the test results should not include the results of an initial failed test on a green engine that was brought into conformity with emissions standards by degreening for up to 300 hours (for locomotives), as allowed by §1033.315(d), in lieu of using a green engine factor. The commenter noted that if the engine as received meets all emission standards, the manufacturer knows that the emissions of particulates, hydrocarbons, carbon monoxide, and smoke will decline as the engine breaks in, and the emissions of oxides of nitrogen will decrease with increasing engine hours; thus, the engine is unlikely to exceed emissions standards. The commenter stated that if the engine exceeds standards on one or more constituents, a degreening run is made to stabilize emissions.

With regard to the request for comment on whether manufacturers should be allowed to use a pre-stabilized catalyst instead of an unstabilized (or "green") catalyst and, if so, should it require some additional procedure for assuring proper in-use operation with production catalysts, EMD commented that manufacturers should be able to: test with a green catalyst, with the application of a 'green catalyst factor;' to operate the engine on its own property for the period necessary to stabilize the catalyst (though operation of engines of locomotive or Category 2 (C2) marine size for extended periods is expensive); to apply a previously aged catalyst to simulate operation in service; or, to introduce a locomotive engine to service for catalyst aging and recover it after a short interval for production line testing.

With regard to the request for comment on whether a locomotive selected for production-line testing should be allowed to be introduced into service provided it is tested within the first 10,000 miles of operation, EMD commented that it believes that the interval of 10,000 miles is too short. The commenter stated that once a locomotive is introduced to service, recovering it can be difficult, and the locomotive could possibly be accumulating significant mileage during that time period. EMD again recommended that a mileage accumulation of 45,000 miles would be more realistic than 10,000 miles for a production line test of catalyst-equipped units.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1

Our Response:

We agree that manufacturers should be allowed to use special procedures for production line testing of catalyst-equipped engines. However, we do not agree that manufacturers should be allowed to apply a previously aged catalyst to simulate operation in service. Such an approach would not provide any information about the production quality of the catalysts or the final assembly process. We are adopting the following provisions instead.

For locomotives, the new regulations will allow a locomotive to be used in service for up to 1,000 hours of engine operation prior to testing, which we believe will be sufficient time to degreen a catalyst. We believe that this approach should work well for locomotives given the very close working relationships between the manufacturers and the major railroads.

We do not believe this locomotive approach would work for marine engines because the marine market is much more diverse and the very close working relationships cannot be assumed. Therefore, we will rely on our general authority to approve alternate PLT programs. Should a consensus develop in the future about how to appropriately verify that engines and catalysts are produced to conform to the regulations, we may adopt specific regulatory provisions to address these marine engines.

We are also continuing to also allow the conventional PLT approach for catalyst equipped engines. In that approach, a manufacturer would be required to assemble and test the engine with a complete catalyst system. At the manufacturer's choice, the engine could be broken in by operating it for up to 300 hours, or it could be tested in a "green" state and its measured emissions adjusted by applying "green engine factors".

Finally, we agree that failure of a green catalyst may warrant special consideration. As such the final regulations specify that a manufacturer may ask us to allow it to exclude an initial failed test if all of the following are true:

(1) The catalyst was in a green condition when tested initially.
(2) The locomotive/engine met all emission standards when retested after degreening the catalyst.
(3) No additional emission-related maintenance or repair was performed between the initial failed test and the subsequent passing test.

4.1.1.3 Audits

What Commenters Said:

EMD commented that the proposal carries over the audit sample size requirement of Part 92 to audit the installation of remanufacture systems at a rate of five percent of sales per year per installer, with a maximum requirement of ten per year per installer. The commenter stated that it believes that this requirement could be impossible to comply with, because an installer could purchase twenty remanufacture systems and put them all on the shelf (thus triggering a requirement under the present rule to audit one installation, but no installations would have occurred). The commenter recommended changing the audit requirement to five percent of installations per year per installer, again with a maximum of ten audits per year per installer.

EMD also commented that the proposed provision (from Part 92) that an audit be completed within 10,000 miles of remanufacture system installation to be valid is difficult to comply with, and urged that the 10,000 mile requirement be changed to 45,000 miles to make this provision more reasonable to comply with. EMD noted that proposed §1033.340(g) requires that the reports of installation audits must be submitted within 30 calendar days of the end of each quarter and requested that the §1033.340(g) requirement be changed to 45 days.

EMD commented that while the majority of remanufacture system installations occur on major North American railroads, a few occur on small regional or local railroads, incurring an audit requirement under the regulations currently in place. The commenter noted that it is very difficult for it to support the installation audit requirements on these railroads, as EMD has no service presence there, and in most cases EMD does not even sell the kit directly to the railroad (it is handled through a distributor) and that a low threshold were to be set for the installation audit requirement. The commenter further suggested that it would be de minimis to include a provision which stated, in effect, that if a Class III railroad (a local line haul or switching and terminal carrier) installed five or fewer kits in any given year, no audits of those installations would be required. The commenter lastly noted that it has kit sales of about 600 per year—adding this provision would probably mean that 10 or less installations per year would not be covered by an audit.

EMD also requested that EPA make the following changes to 40 CFR Part 92 of the regulations: 1) a revision of the remanufacture system audit sample size requirement from five percent of sales per installer to five percent of installations per installer; 2) a revision of the maximum mileage for a valid audit of a remanufacture system installation to 45,000 from 10,000; and, 3) an exclusion from audit requirements for remanufacture system installations on five or fewer locomotives of Class III railroads.

<u>Letters:</u>
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1

Our Response:

In general, we agree with EMD's comments, and have largely incorporated them into the final regulations. However, we are not excluding locomotives owned by small railroads from the auditing requirements. While these locomotives represent a smaller part of the inventory than the larger railroads, they are still significant sources. Nevertheless, we do see EMD's point about the burden of auditing such locomotives. Therefore, the final regulations include an allowance for the railroad to perform the audit and submit it to EPA through the certificate holder.

4.1.1.4 SEA Test Location

What Commenters Said:

EMA commented that it believes the requirement to specify a test location for SEA testing in the U.S. (§1042.205(bb)(3)) imposes an unnecessary burden on engine manufacturers—the commenter suggested that it should be sufficient to specify a test location, and not specifically one in the U.S. The commenter noted that manufacturers generally have test facilities that are in compliance with the requirements for certification, and suggested that EPA accept those test facilities for SEA if necessary. The commenter pointed out that marine engine families are generally built in much smaller volumes than on-highway or nonroad engines, and it believes that this new requirement should not be added for marine engines accordingly. The commenter noted that many marine CI engines have power outputs well above the normal automotive power range, making it potentially difficult to find a US-based test facility capable of performing such testing. Lastly, the commenter noted that the cost of setups, troubleshooting, and external test support can be extraordinary compared to conducting tests within the manufacturer's typical location.

<u>Letters:</u>
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

Sections 206 and 208 of the Act provide EPA with broad authority to require manufacturers to test production engines to determine whether they are being manufactured to conform to the applicable regulations. We have previously promulgated SEA regulations in Subpart E of Part 1068 under this authority. In §1068.401(b) of those regulations, we state:

> If we send you a signed test order, you must follow its directions and the provisions of this subpart. We may tell you where to test the engines. This may be where you produce the engines or any other emission testing facility.

This provision recognizes that where an engine is to be tested is an important consideration for SEAs. It can affect whether EPA can practically witness the testing to verify that it is done properly. It also can affect the degree of confidence EPA and the manufacturer have in the results. Both are more likely to have confidence in the results if they have prior experience with the test facility. In addition, we have greater confidence in test results when they are performed under U.S. jurisdiction. For domestically produced engines, consideration of these factors makes testing at the manufacturer's facility a reasonable practice. This is not true for imported engines.

The proposed requirement to specify a test location for SEA testing in the U.S. is intended to simplify this process of determining where imported engines are to be tested. By having them name a U.S. facility in their application, we are allowing them to make whatever arrangements they feel are necessary to allow them to have confidence in the test results if we require the engines to be tested in the U.S.

We agree that testing very large engines needs special consideration. As the size the engine increases, the number of facilities that can test them decreases. This could make naming a U.S. test facility for these large engines problematic. For this reason, we are revising the proposed provision to exclude engines over 560 kW. We will still retain the authority to specify where the testing is to be performed (including whether it must be tested at a U.S. facility). Should we decide to specify a test facility other than the manufacturer's normal test facility for those engines, we would likely work with the manufacturer to select an appropriate test facility.

As for the other objections raised by the manufacturers, they are more accurately objections to the existing regulatory provision in §1068.401(b) that allows us to specify any test facility for SEAs. We did not propose to change that provision and are not revising it.

Finally, it is worth clarifying that requiring manufacturers to specify locations for SEA testing in the U.S. does not preclude us from allowing foreign manufacturers to perform SEAs at their non-U.S. production facilities.

4.1.1.5 Failure

What Commenters Said:

EMD commented that §1033.310(d), the requirement for retesting after a test failure, is ambiguous and should be reworded.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502 (hearing), 0594.1

Our Response:

It should first be noted that the EMD comment relates to an example rather than a regulatory requirement. So while we have revised this provision to make the example clearer, it does not change the requirement. See the regulatory text for the revised language.

4.1.2 Defect Notifications

What Commenters Said:

EMD commented that it believes the defect-reporting requirements of §1068.501 are unnecessary in the locomotive and Category 2 marine engine industries. The commenter suggested that EPA revert to the requirements of Parts 92 and 94. The commenter noted that the locomotive and Category 2 marine engine markets are relatively small so information flows freely because manufacturer and owner/operator personnel generally are acquainted with each other (and the latter are not reluctant to contact the former if a problem arises). The commenter also noted that frequently, manufacturer personnel are aware on a locomotive-by-locomotive, or engine-by-engine, basis of what is occurring. The commenter stated that it believes that these circumstances render it unnecessary to track such secondary indications as parts sales or quality assurance procedures in an attempt to divine whether there may be a defect occurring. Lastly, EMD commented that if EPA is unsatisfied with the level of defect reporting occurring under the rules currently in force, those procedures should be revised in a targeted manner, rather than imposing the onerous and totally unnecessary procedures of Section1068.501 on the locomotive and Category 2 marine engine markets.

General Electric Transportation (GE) commented that it believes the enforcement, defect, and recall provisions of the rule should be clear and avoid disruption to rail commerce. The commenter also stated that it believes the proposal requiring extensive tracking of information related to components triggering defect investigation and reporting should be narrowed and clarified. The commenter suggested that EPA make three changes to these provisions as they apply to locomotives (and other engines as well):

1) Limit the requirement to track and assess data to the information in §1068.501(b)(1)(I) and not impose the requirement for subparagraphs (ii) and (iii).
2) Include in paragraph (b)(1) a clear statement that subparagraph (b)(1)(iii) does not require data-tracking or recording of information related to shipment of replacement parts.
3) Clarify or delete paragraphs (b)(1)(ii) and (iii) to ensure that obligations of the manufacturer and remanufacturer are clear and that they are able to understand the specific requirements applicable to their conduct with regard to violations.

GE commented that if EPA continues these aspects of the rule for other types of nonroad engines and equipment, it is reasonable for the Agency to continue with the approach in the existing Part 92 rules for defect investigations for locomotives (and the corresponding current provisions for marine engines). The commenter noted that reliability is a hallmark of the industry, since, unlike the trucking industry, a locomotive cannot be simply pulled off the rails when a breakdown occurs. The commenter noted that locomotive builders invest substantial engineering resources in testing and validating their operations, as railroads cannot afford for a large number of locomotives to become unavailable due to the limited number of locomotives in the active fleet or to block rails due to breakdowns (the economic consequences to an individual railroad and to other railroads moving freight on the track would be too severe).

GE commented that EPA should consider, when revising this portion of the rules, that the certificate holder does not always have access to the engine or components that would be necessary to conduct a thorough investigation that, in turn, would enable the determination if an emission defect is present and/or if the failure was due to abuse, accidental damage, or other cause unrelated to the design of the engine or component. The commenter suggested that a provision be included in the regulations that allows a reasonable time period for an investigation - recognizing the burden on the railroads when locomotives must be taken out of service for an investigation - and that locomotive owners and operators should be required to cooperate with investigations and make available data and equipment requested by a certificate holder in conducting an investigation.

EMA commented that it supports the proposal to apply the defect notification requirements that are set forth in Part 1068 to marine and locomotive engines. The commenter stated that it believes that this will allow engine manufacturers to implement common defect reporting procedures for all of their nonroad engine products.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1
General Electric Transportation (GE)OAR-2003-0190-0590.1

Our Response:

As EMA noted there are advantages to applying the common defect reporting of §1068.501 to all engine categories. However, we also see some veracity in EMD's and GE's comment that the locomotive industry is unique in some respects. Thus, while we are finalizing the proposed provision that applies §1068.501 to locomotives, we are also specifying that the defect *investigation* requirements of 40 CFR 1068.501 should be applied "consistent with normal locomotive industry practice for investigating defects". This additional provision in §1033.601 is intended to recognize that locomotive manufacturers and the railroads have very close working relationships and have a long history of tracking and correcting defects. We are also noting that this would not require manufacturers track parts shipments as indicators of possible defects, since many more parts for remanufacturing and maintenance that because of defects. We do not expect that the application of §1068.501 as specified in §1033.601 will require manufacturers to fundamentally change their defect tracking practices.

As noted above we believe our changes to §1033.601 will mean that locomotive manufacturers will not need to make significant changes to how they track and report defects. For that reason, and because we did not propose any significant changes to Part 1068 in this rulemaking, we do not believe that we need to address here the more detailed comments raised by GE. Nevertheless, we do believe that they are worth considering and will address them along with other comments on §1068.501 in a separate ongoing rulemaking.

With respect to marine engines, we are adding a special provision for manufacturers that also manufacture other nonroad engines (including locomotive engines) that are substantially similar to their marine engines. We will allow those manufacturers to consider defects using combined marine and non-marine families. Thus, companies such as EMD would be allowed include their Category 2 marine engines in the same defect program they use for locomotives.

4.1.3 Proposed Changes to Record-keeping and Reporting Requirements

Marathon Petroleum Company LLC (Marathon) commented that it believes EPA should note that the proposed standards put significantly more burden on owners and operators for compliance with emission limits and that this is a change from previous regulations in this sector that mainly relied on manufacturers for compliance. The commenters presented the example of the installation and operation of aftertreatment control technology for the Tier 4 standards, but did not detail how this would be a burden. The commenter stated that these requirements will increase the cost of compliance but require engine owners and operators to understand EPA regulations, thus the commenter believes that the recordkeeping and reporting burden should be minimized for marine engine owners and operators as they are not likely familiar with reporting requirements (and may have difficulty complying with the requirement to notify EPA of urea system operating incidences within 30 days). The commenter also noted that these vessels are frequently away from their home port for greater than 30 days at a time.

EMA commented that Part 1033 would require a large amount of record-keeping and reporting of information relating to PLT and in-use testing (see §1033.325(e) for PLT and §1033.425(a) for in-use testing requirements). The commenter stated that it believes that this record-keeping and reporting requirement will impose time and financial burdens on both the certificate holder and the Agency, while yielding no environmental benefits. The commenter suggested that if these record-keeping and reporting requirements cannot be eliminated completely, they should at least be reduced in size and scope. The commenter offered an example that the reporting of PLT results could be required annually instead of quarterly. The commenter also suggested the option of focusing the PLT reporting requirements on the failure of a PLT, and only require reporting if there is a failure (and no reporting if engines/locomotives pass).

<u>Letters:</u>
Engine Manufacturers Association (EMA)   OAR-2003-0190-0575.1
Marathon Petroleum Company LLC OAR-2003-0190-0595.1

Our Response:

Both commenters expressed a general objection to the amount of recordkeeping and reporting required, but sited few specific examples. We are not able to analyze the general comment and can only say that we disagree with it. We are responding to the PLT-related comments in section 4.1.1 above.

We disagree with Marathon’s comment that reporting operation without urea is too burdensome. Most importantly, we disagree because this reporting will only occur in cases in which the operator violates the regulations. To whatever extent the reporting would constitute a burden, it also creates an incentive to comply with the regulations. However, we also disagree that merely sending a report constitutes a significant burden.

4.1.4 Staged and Delegated Assembly

EMD commented that the exemption provisions of 40 CFR 1068.260 (which allow shipping engines separately from their aftertreatment components) should apply for locomotives. With regard to the temporary staged-assembly exemption in §1033.630 (to allow completion of production of engines and locomotives at separate facilities), EMD commented that it believes that EPA should realize that assembly of engines and locomotives at separate facilities is routine in the locomotive industry. The commenter stated that requiring an exemption to do this ("and more egregiously, a temporary exemption") is a major disruption to the way that locomotive manufacturers have done business since time immemorial. The commenter recommended that that this section be dropped from the rule, and that the exemption of §1068.260 be allowed in the locomotive market.

GE commented that it believes EPA should clarify the proposed provision on staged assembly (§1033.630)—specifically, that it does not require an exemption for the manufacture of engines at one plant and installation in locomotives at another plant. The commenter noted the example of engines being manufactured and tested at one plant and locomotives being assembled and produced out of another. The commenter does not believe that this constitutes a stages assembly, but rather a normal manufacturing process. The commenter stated that it believes that proposed §1033.620 would apply to a situation where an engine is actually in a locomotive but requires additional work at another facility to complete a certified installation.

EMA commented that it believes that the application of the general nonroad provisions associated with delegated assembly to marine and locomotive engines is problematic. The commenter noted that for marine engine manufacturers, virtually every engine will be covered by these provisions as there are no integrated marine vessel/engine manufacturers. The commenter also noted that aftertreatment systems for marine engines generally will be integrated into the vessel design due to both space and safety considerations. The commenter suggested that the cost of the aftertreatment devices not be included in the cost of the marine engine because the engine manufacturer does not have control over the design or packaged cost of the aftertreatment system. The commenter stated that it believes that engine manufacturers should be allowed to provide the vessel manufacturer the design requirements for the aftertreatment system as certified with the prescribed installation instructions.

EMA commented that it believes that the audit requirements associated with the equipment manufacturer must be revised to be applicable to the marine vessel manufacturing industry. EMA also commented that it believes that the aftertreatment order-to-engine shipment relationship must be revised to reflect the marine industry. The commenter noted that vessel construction can be a lengthy process resulting in a significant time discrepancy between when the engine is shipped and when the aftertreatment system is ordered—engines are often ordered and installed in the early stages of the vessel construction with the exhaust, and in this case aftertreatment system, being ordered and installed significantly later in the vessel assembly process.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1
General Electric Transportation (GE) OAR-2003-0190-0590.1

Our Response:

We proposed to treat delegated and staged assembly differently for locomotives and marine engines because of factual differences between the two sectors; most notably the fact that we have engine-based standards for marine engines but chassis-based standards for locomotives. We continue to believe that the requirements for marine engines are sufficiently similar to other our engine-based program for other nonroad diesel engines that we should apply the same delegated assembly requirements in §1068.260. It is also important to note that we recently proposed to modify §1068.260 to address manufacturer concerns (72 FR 28097, May 18, 2007). We will continue to work with affected manufacturers (including marine manufacturers) in that rule to address their concerns.

We are modifying the provisions of §1033.630 to address the comments of EMD and GE regarding staged and delegated assembly of locomotives. We are incorporating parallel provisions in this section rather than applying the provisions of §1068.260 to locomotives. Nevertheless, we would allow manufacturers to use the provisions of §1068.260 as an option for locomotives. Although the provisions on §1068.260 are in many ways more stringent, they might represent an attractive option for manufacturers also using them for other types of engines.

We recognize that assembly of engines and locomotives at separate facilities is routine in the locomotive industry. Thus, while we believe an exemption is appropriate for this practice, we want to make obtaining such an exemption to also be routine. We have added regulatory language to allow the manufacturers to request the exemption in their applications for certification and to make approval of the exemptions automatic when we approve the application for certification. We are also clarifying that no exemption is needed if the engines are in their certified configuration and properly labeled.

While it may seem to be inappropriate to require an exemption for a routine process, this approach is necessary to allow us to effectively enforce our emission standards. By requiring pre-approval to ship locomotive engines in non-certified configurations, we prevent someone who is caught distributing nonconforming engines in U.S. commerce in violation of the regulations from claiming after the fact that they were merely shipping them to a separate location where they would be brought into a certified configuration.

It is also worth clarifying the "temporary" nature of the exemption. This language is required to be technically correct in the regulations and merely means that the exemption applies for one step in the process. For a given locomotive, the exemption would be effective for the time between the beginning of the assembly process and the point at which it is assemble into the locomotive. The exemption does not apply after that period, and the locomotive must be covered by a certificate of conformity.

4.1.5 Replacement Engine Provisions

4.1.5.1 Marine Engines

See Chapter 3.

4.1.5.2 Locomotive Engines

What Commenters Said:

EMD noted that EPA states that the exemption provisions for new replacement engines of 40 CFR 1068.240 do not apply for locomotives; the commenter believes that an exception should be made for locomotives originally manufactured prior to 1973, as they are not governed by the locomotive emissions rule unless upgraded.

EMA recommended that EPA should provide a replacement engine provision for failed locomotive engines, at least for catastrophic failures, up to some reasonable point in the engine's life given the remanufacturing requirements. The commenter further recommended that after an engine is remanufactured to newer standards, a replacement engine provision should allow a replacement engine to be built to that newer configuration instead of only allowing engines to be built to the current new engine requirements. The commenter stated that it believes that the need for such a provision becomes very clear when dealing with a multiple engine locomotive with a single engine catastrophic failure, otherwise requiring multiple tier engines in a single locomotive would be unmanageable for the end-user.

Letters:
Electro-Motive Diesel, Inc. (EMD)   OAR-2003-0190-0594.1
Engine Manufacturers Association (EMA)   OAR-2003-0190-0575.1

Our Response:

In both the Part 92 and Part 1033 regulations, we classify repowering a used locomotive with an unused (or freshly manufactured) engine to be a form of remanufacturing that is subject to emission standards. The existing regulations contain no replacement engine exemption, and we continue to believe that such an exemption would be inappropriate for locomotives.

With respect to pre-1973 engines, we are revising the regulations to clarify replacing the engine with a freshly manufactured engine would be considered to be upgrading the locomotive.

Such locomotives would be subject to the same Tier 0 standards as 1973 locomotives.

4.1.6 Mexican and Canadian Locomotives

What Commenters Said:

EMD and GE commented that the Notice of Proposed Rulemaking (NPRM) contains language that would prohibit designs that readjust injection timing of an emissions-certified locomotive to improve fuel consumption, at the expense of NOx emissions, when it is operating in Mexico, and reverse the readjustment to allow the locomotive to conform to all emissions standards when it returns to the United States. Both commenters believe that EPA lacks authority to do so.

EMD noted that EPA asserts that the emissions from a locomotive incorporating a global positioning system (GPS)-controlled auxiliary emission control device (AECD) would likely be harmful both to Mexican and United States citizens due to emissions transport. The commenter noted that the same is true of any locomotive operating solely in Mexico and conforming to no emissions standards, as Mexico has no locomotive emissions rules. The commenter also stated that, because of the limited range of possible injection timing adjustment (and injection timing not being the only measure used to reduce NOx emissions), the overall NOx emissions of the locomotive with the adjustment triggered by GPS data are likely to be lower than those of any nonconforming locomotive that the new locomotive would replace. EMD also commented that EPA exempts exported locomotives from the provisions of its rules, as EPA's authority does not extend beyond United States borders, and requires imported locomotives to be brought into compliance with EPA rules. The commenter stated that the locomotive with the feature that EPA seeks to prohibit is one that repeatedly exports and imports itself. The commenter noted that when it exports itself, it readjusts itself to improve fuel consumption; when it imports itself, it brings itself into compliance with the emissions standards appropriate to its date of original manufacture, or remanufacture if different, in accordance with EPA requirements.

GE stated that the interpretation stated by EPA in the preamble to the proposed rule is an assertion of extraterritorial jurisdiction that has no basis in the Clean Air Act (CAA). GE noted that it is a longstanding principle of American law "that legislation of Congress, unless a contrary intent appears, is meant to apply only within the territorial jurisdiction of the United States." EEOC v. Arabian Am. Oil Co., 499 U.S. 244, 248 (1991) (quoting Foley Bros. V. Filardo, 336 U.S. 281, 285 (1949)). The commenter stated that this principle serves to protect against unintended clashes between our laws and those of other nations which could result in international discord. GE further commented that, applying this principle to the instant case, there is no basis for concluding that Congress intended locomotive emission standards to apply when locomotives operate outside the United States. The commenter also stated that it does not agree with the statement that EPA might have jurisdiction in Mexico because these systems "cause emission exceedances when a locomotive crosses the U.S. border into a foreign country are considered defeat devices and are not permitted" (72 FR 16002). GE commented that a system cannot cause an exceedance if the locomotive is in Mexico, because Mexican law is applicable in Mexico, not EPA locomotive rules. The commenter further stated that EPA has no basis to state that when "a locomotive is certified, it should comply with U.S. standards and requirements during all operation," when that operation might be outside of EPA's jurisdiction. GE also commented on the statement that "since emission labels have to contain an unconditional statement of compliance, non-compliant operation in any area, including a foreign country, would render the label language false, and this is not allowed." The commenter stated that, whether or not a tag on a locomotive is accurate during locomotive operation in another country violates no prohibition in the EPA rules.

The New York State Department of Environmental Conservation commented that it strongly supports EPA's clarification of the applicability of the proposed standards to foreign-owned locomotives operating in the United States.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
General Electric Transportation (GE) OAR-2003-0190-0590.1
New York State Department of Environmental Conservation, Office of Air Resources OAR-2003-0190-0583.1

Our Response:

We disagree with the commenters' claim that EPA does not have the authority to restrict the types of AECDs in question for locomotives introduced into U.S. commerce. Section 203(a)(3) of the CAA gives EPA broad authority to prohibit the installation of components that render emission controls inoperative. Neither the CAA nor the existing regulations provide any exceptions for AECDs that only operate outside the U.S. Historically, we have prohibited such AECDs because of concerns over their potential adverse impacts on U.S. air quality. Exhaust pollutants can be transported long distances, and thus, emissions that occur outside the territorial boundaries of the U.S. can impact air quality within the U.S.

While the commenters raised their concerns in the context of locomotives, we believe they potentially apply more broadly to other nonroad engines, particularly ocean-going vessels that travel in international waters. We are not finalizing any revisions to the existing regulatory provisions specific to this issue in this rulemaking. However, we do agree that there are important factors related to this issue that should be considered broadly for nonroad engines. Therefore, we expect to review this issue more broadly in the context of a future Category 3 marine rule that is currently under development by EPA. Commenters can renew their claim on this issue at that time.

4.1.7 Other Exemptions

4.1.7.1 Hardship Provisions for Locomotive Manufacturers and Remanufacturers

What Commenters Said:

EMD commented that it believes that the hardship provisions of §1033.620, which are carried over from Part 92, fail to address the real danger facing locomotive manufacturers and remanufacturers—that locomotives of one Tier might be stranded on the assembly line by an event beyond the manufacturer's control beyond the compliance date for the next Tier. The commenter noted that such events might include: a strike at the manufacturer's facility or at that of a key supplier; a fire that shuts down production, again at either the manufacturer's facility or at a supplier's; 'acts of God' (storms, floods, etc.) that shut down part or all of a production plant; and/or transportation disruption that prevents delivery of key components. EMD commented that the §1033.620(b)(1)(ii) requirement that manufacture of the locomotives be substantially completed prior to the applicability date of the standards for which the manufacturer seeks relief prevents the hardship provisions from being applicable in such cases, and effectively makes them useless to manufacturers.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1

Our Response:

The purpose of this exemption is to provide relief to manufacturers in those cases in which they have a significant investment into a locomotive that cannot be completed in time to comply with the regulations. However, we believe that EMD is misinterpreting the term "substantially completed prior to the applicability date of the standards". They seem to be reading the phrase "substantially completed" to mean more complete than we actually intended. We do not mean that a locomotive needs to be 90 percent complete or even 50 percent complete. Rather we mean that a locomotive would need to be assembled to a degree that it represented a substantial investment by the manufacturer toward meeting the standard on time. In general, we would likely consider locomotives "on the production line" at the time of the delay to be eligible for relief. It is also important to note that even without hardship relief, manufacturers can introduce into commerce locomotives meeting the previous Tier of standards by using averaging, banking, and trading (ABT) credits. Thus we are not modifying the proposed regulatory language.

4.1.7.2 Reporting to EPA the Number of Locomotives Exempted Annually

What Commenters Said:

EMD commented that §1033.250(a)(2) sets a requirement that manufacturers report to EPA the number of locomotives exempted each year. The commenter stated that it believes EPA should make clear that this reporting requirement extends only to locomotives included under manufacturer-owned, testing, display, etc. exemptions, and not to those exempted in accordance with the provisions of §1068.230 because they were exported.

Letters:

Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1

Our Response:

We agree with this comment and are revising the regulations to exclude exported locomotives from the reporting requirement.

4.1.7.3 Small Railroads

What Commenters Said:

GE commented that it believes EPA should revise certain elements of the small business provisions. The commenter requested that EPA clarify that the original equipment manufacturer (OEM) is not responsible for determining whether a railroad qualifies as a "small railroad" under the regulations.

Letters:
General Electric Transportation (GE) OAR-2003-0190-0590.1

Our Response:

We believe the best way to ensure that certificate holders exercise due diligence in the application of their certificates is for them to be potentially liable for their misapplication. Thus, we will not categorically absolve the certificate holder in the regulations. Nevertheless, we do believe it is important to state here that we would not expect to apply penalties to the certificate holder for misapplication by a non-small railroad where we believed the certificate holder did exercise due diligence. We are also adding to §1033.610 a note that certificate holders may require written confirmation from the owner/operator and that such written confirmation to a certificate holder is deemed to also be a submission to EPA. In the absence of other information indicating that the certificate holder should have known otherwise, we would consider obtaining such written confirmation to qualify as due diligence.

4.1.7.4 National Security

What Commenters Said:

The Department of Defense (DoD) Clean Air Act Services Steering Committee (CAA SSC) recommended that EPA remove §1042.601(b), and add a new section that uses the same national security exemption language contained in 40 CFR 94. The commenter stated that it believes that, as drafted, the language will not extend the national security exemption to qualified marine compression-ignition engines covered by the proposed rule, and will also lead to confusion amongst the regulated community and the regulators charged with enforcing the regulation. The commenter stated that it believes the clearest way to provide for a national security exemption is to use the same language in §94.908 and to state the language directly in Part 1042. The commenter recommended that EPA remove §1042.601(b), and copy the national security exemption language §94.908 directly in the new Part 1042, Subpart G - Special Compliance Provisions.

Letters:
Department of Defense CAA Services Steering Committee OAR-2003-0190-0568.1

Our Response:

While we do not necessarily agree with the comment, we see no harm in specifying the national security exemption for marine engines in a single regulation section. Thus the final regulations do so.

4.1.7.5 Approval of Testing Exemptions

What Commenters Said:

EMD commented that the Part 1068 requirement that manufacturers obtain an exemption from EPA prior to testing locomotives in revenue service is a carryover from the Part 92 regulations, and stated that the process under Part 92 has not worked well. The commenter noted that disposition of exemption requests came quickly initially, but after the retirement of the person who was handled them, the dispositions slowed down markedly, or have not come at all. The commenter stated that it believes that the staff at the Certification and Innovative Strategies Division is insufficient to handle the volume of requests. The commenter further stated that the situation of slow or no dispositions is intolerable for a company that needs to run field tests of new technology in order to make design progress, but does not want to be in violation of EPA rules. To remedy this situation, the commenter suggested that testing exemptions should be granted to manufacturers without the necessity for waiting for an approval, with the following requirements: manufacturers must submit to EPA the information required by §1068.210(d), at least 30 calendar days prior to commencement of the test (the commenter stated that submission via e-mail, with hard copy via regular mail, would be acceptable due to the irradiation requirements for mail addressed to the ZIP code of EPA Washington offices); EPA would have 30 calendar days from the date of the e-mail submission to request modification to (or to deny) the exemption, and no response or denial by EPA within that period would constitute approval of the exemption; and, the manufacturer must comply with the requirements of §1068.210(e). EMD included a similar comment about our approval processes in general.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502, 0594.1, 0662

Our Response:

We agree with the EMD that it is important to process requests for testing exemptions quickly to facilitate the development of new technologies. We commit to evaluate our review practices to eliminate any unnecessary delays for testing exemptions and other approvals.

4.1.8 In-Use Standard Adjustments

What Commenters Said:

Caterpillar, Inc. and EMA commented that they support the use of in-use adjustments for locomotives. The commenters stated that they believe that the magnitude of the NOx in-use adjustments are probably adequate for locomotive applications (§1033.250, Table 1); however, they believe that the particulate adjustments are not adequate and do not reflect the uncertainty of particulate filter technology. The commenters also stated that the likelihood of inadequate control of particulates for several years as experience is gained is much greater than for NOx aftertreatment. The commenters suggested that the in-use adjustment for particulate matter (PM) should be increased to at least 0.03 g/bhp-hr for locomotives that the in-use adjustments for both marine and locomotives should extend for at least four model years past the introduction date of the new standards to allow the identification of problems, development of solutions to the problems, and allow for the possibility that initial corrections may not be completely adequate. The commenter stated that the in-use adjustment increment for the fourth model year could be reduced by some percentage to account for the expectation of a substantial improvement if not a complete solution. Lastly, the commenter suggested that any in-use adjustments for PM should be extended to Tier 3 due to the substantial PM reduction proposed in the rules. EMA further commented that t it believes that the in-use adjustments should apply to the base cycle standards, which would be the basis for the not-to-exceed (NTE) levels after applying the appropriate factors.

EMD noted that §1033.150(f) provides an adjustment to be applied to the NOx standards and family emissions limits (FELs) of freshly manufactured 2017 through 2019 line-haul locomotives for determining compliance with standards during in-use testing. The commenter stated that it appreciates this flexibility but believes that it should also be applied to model year 2015 and 2016 Tier 4 line-haul locomotives fitted with NOx aftertreatment at remanufacture. The commenter further stated that this is in accordance with the provisions of footnote c of Table 1 of §1033.101, as the aftertreatment technology fitted to such remanufactured locomotives is likely to be similar to that applied to freshly manufactured 2017 through 2019 model year locomotives.

GE commented that it supports extending the number of model years over which an in-use NOx add-on would apply while at the same time lowering the in-use add-on significantly. Specifically, GE supported an in-use add-on of 0.6 g/bhp-hr to apply until model year 2023. The commenter believes such an approach provides a more appropriate compliance path for what will be very challenging Tier 4 technology implementation.

<u>Letters:</u>
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0591.1

Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1
General Electric (Supplemental Comment)[1]

Our Response:

We believe it would be appropriate to provide alternative sets of margins available to manufacturers willing to accept more stringent in-use compliance levels for NOx in exchange for somewhat less stringent levels for PM, and that it would be appropriate to apply these margins to marine engines. We also believe it would be appropriate to provide alternative sets of margins available to manufacturers willing to accept more stringent in-use compliance levels for NOx in exchange for the NOx adjustments applying to additional model years. Thus we are revising §§1033.150 and 1042.145 to make these changes.

With respect to the model years for which these adjustments should apply, we agree that they should be available for Tier 4 engines that meet the standards early. However, we do not agree that they should be available for engines produced more than three years after the Tier 4 standards begin to apply.

With respect to how the adjustments will apply for the marine NTE standards. The final regulations specify that they are to be added to the NTE standards that are calculated from the duty cycle standards. Manufacturers may not calculate NTE from the adjusted duty cycle standards. This approach is consistent with the regulations in 40 CFR part 1039.

4.1.9 Non-SCR Diagnostics

What Commenters Said:

AAR noted that the NPRM contains general requirements for diagnostic systems, requires diagnostic systems for selective catalytic reduction (SCR) systems, and requests comment on whether Tier 4 locomotives should be equipped with diagnostic systems. The commenter questioned why diagnostic systems would be required at all; noting that, insofar as compliance with EPA standards is concerned, only locomotives are subject to in-use testing. Thus, the commenter stated, there already is a mechanism in place for determining whether locomotives are operating properly from an emissions perspective. AAR commented that it believes that it is counterproductive for EPA to impose requirements for diagnostic systems that only apply if a manufacturer chooses to include diagnostic systems. The commenter stated that such requirements provide a disincentive to manufacturers to include diagnostic systems, and the disincentive is particularly strong for diagnostic systems based on new technology.

AAR also commented that it believes that it is vitally important that EPA not require

1 Email from Shannon Broome, General Electric, to Byron Bunker, U.S. EPA, Re: Supplemental Comment of General Electric - February 12, 2008

railroads to take locomotives out of service because of a diagnostic system malfunction. The commenter suggested that EPA require the repair of any mandated diagnostic system the next time the locomotive is at a shop capable of performing the repairs or during the next periodic inspection. Regarding the proposal to require malfunction indicator lights, AAR commented that it is concerned that given the transient conditions that occur during the operation of locomotive engines, malfunction indicator lights might briefly turn on during transient conditions even though there has been no malfunction. The commenter stated that it is concerned that the proposed provision to require that malfunction indicator lights to remain on for twenty-four hours, unless the engine is serviced, could result in lights going on with such frequency that engineers will ignore them and they will not serve a useful function. AAR suggested that EPA only regulate mandated diagnostic systems and address the repair of mandated diagnostic systems through the following new subsection: "Defective diagnostic systems must be repaired the next time the locomotive is in a repair shop equipped to make repairs or at the time of the next periodic inspection required by 49 C.F.R. §229.23, whichever occurs first."

The New York State Department of Environmental Conservation commented that it believes that that engine diagnostics programs would be equally valuable for Tier 4 marine engines. The commenter noted that modern marine engines have electronic controls to monitor and control engine operation, and further stated that these electronic controls can be quickly developed into an emissions diagnostic system for the marine engine. The commenter suggested that this diagnostic system and repair log could be reviewed during a vessel's safety inspection. The commenter noted that timely identification of defects in emissions control systems, and prompt, effective, repair of those defects is essential to ensure that the potential emissions reductions of a regulatory program are realized; thus the commenter urged EPA to require emissions control diagnostic systems that will identify emission control system defects. The commenter stated that if such remote maintenance diagnostic systems already exist in the railroad industry, extending such systems to monitor emissions control system components should not pose an insurmountable burden to the industry. The New York State Department of Environmental Conservation commented that once a defect is identified, it is necessary for the owner/operator to take action to correct the defect. Thus the commenter urged EPA to implement an Inspection and Maintenance (I&M) program, where locomotive emissions diagnostics are periodically checked, and the results of the inspection and any necessary repairs documented.

GE commented that it believes the technology for on-board diagnostics (OBD) is not sufficiently reliable to impose as a regulatory requirement and the proposal creates disincentives to their introduction. The commenter further stated that it believes that the in-use and production line test programs are sufficient to assure compliance.

GE commented that it believes the rule would need to be revised, at a minimum, to allow the alarm to be recorded, silenced, and addressed at the next regular service interval. However, the commenter stated, EPA should recognize that: (1) it has an effective in-use testing program, and (2) the rule's recall provisions provide tremendous incentives for manufacturers and remanufacturers to design and build locomotives and kits carefully to achieve the standards reliably. GE urged EPA to reconsider its position and not convert OBD into regulatory requirements simply because they are installed on the locomotive. The commenter suggested that EPA instead allow the products to develop and be tried and tested - if they function well, the market will force their use and EPA will not need to create a regulatory program around them.

With regard to OBD for Tier 4 locomotive and marine engines, EMA commented that it agrees with EPA that such a program, if justified, should be focused on monitor functionality and not actual emission levels or thresholds. The commenter also stated that it agrees with EPA that it would be more appropriate to address this issue in a future rulemaking in the broader context of all nonroad diesel engines (and suggested that EPA defer this to a future rulemaking). The commenter believes that, given the broad range of considerations necessary for OBD requirements, attempting to include OBD in the current rulemaking could significantly delay finalization of this rulemaking and possibly could delay the targeted implementation dates.

Regarding the request for comment on whether or not manufacturers should be required to demonstrate that the diagnostic system is capable of verifying proper function of emissions controls, EMD stated that it believes that this has already been address in other provisions of the proposed rule. The commenter noted that there is a proposed requirement that engines equipped with SCR systems have diagnostic systems which detect inadequate reductant supply or quality and illuminate a malfunction indicator light. The commenter also noted that there are in-use testing requirements (Part 1033, Subpart E), which it believes serve as a powerful incentive to manufacturers to assure that their locomotives do meet emissions standards throughout their useful lives, regardless of the circumstances of the production line test. The commenter noted that these in-use tests will be run with the in-use catalyst; and further that failure of an in-use test casts the emissions performance of not only the tested family, but also on all locomotives of similar design, into doubt. The commenter stated that it believes that the in-use testing requirements are so powerful that the value added by a comprehensive diagnostic system is questionable. The commenter noted that it is not aware of another no urea or other reductant quality sensor that would be sufficiently durable for locomotive application that could not be fooled by a carefully chosen, less expensive material. EMD urged EPA to be wary of introducing stringent diagnostic requirements.

Letters:
Association of American Railroads (AAR) OAR-2003-0190-0566.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1
General Electric Transportation (GE)OAR-2003-0190-0590.1
New York State Department of Environmental Conservation, Office of Air Resources OAR-2003-0190-0583.1

Our Response:

We agree with the commenters that stated that a mandatory emission diagnostic requirement is not necessary for locomotives. We also agree that a mandatory emission diagnostic requirement for marine engines would be better addressed in a broader context.

We disagree with New York's comment that we should implement a new inspection and maintenance program for locomotives. Locomotive operators are already subject to the most stringent maintenance requirements of any mobile source category. Thus no new program is needed.

Finally, in response to these comments, we are revising the regulations in §1033.110 to ensure that they do not create a disincentive to install diagnostic systems on locomotives. As noted in section 4.2.8, we are also clarifying in §1033.815 when repairs need to be made.

4.1.10 Refurbished Locomotives

What Commenters Said:

MotivePower, Inc. requested that EPA raise the proration factor for a refurbished switcher locomotive from 0.6 for a 20-year-old locomotive to 0.8 for a 10-year-old locomotive (§1033.705). The commenter noted that refurbished locomotives include multi-engine switcher locomotives that are built on the platform of an older locomotive, and typically only the frame and below-deck components are maintained in the multi-engine conversion process. The commenter noted that these parts have an indefinite lifetime and, for this reason, a locomotive converted to a multi-engine locomotive has durability equivalent to that of a new locomotive. MotivePower also noted that, given the technology-forcing nature of the proposed remanufacture standards, the lifetime of a locomotive will depend more and more on its ability to meet more and more stringent emission standards. In this context, the multi-engine locomotive's lifetime could outreach almost any single engine locomotive, since small-engine emissions control technologies are more available and cost-effective than large-engine emissions control solutions. The commenter stated that increasing the proration factor for a multi-engine locomotive increases its credit producing value and could allow manufacturers to price multi-engine locomotives more competitively. Lastly, MotivePower commented that competitive pricing would result in broader market penetration and faster turnover of an aging switcher fleet to the ultra-clean multiengine locomotive and would thereby generate significantly greater health benefits for communities located near rail yards.

With regard to the incorporation of emission standards and credits for refurbished locomotives (i.e., those that contain less than 50 percent but more than 25 percent, by value, previously used parts) as part of this rulemaking, the Northeast States for Coordinated Air Use Management (NESCAUM) commented that it would support a program that encourages refurbishing older locomotives that would otherwise continue to operate essentially with no emissions improvements.

EMD commented that in §1033.640, EPA has taken the a simple provision in Part 92 for determining whether a locomotive with some new and some previously used parts has to meet freshly manufactured locomotive or remanufactured locomotive standards, and made it more complex without answering the recurrent question of the Part 92 provision—how to value the previously used parts. The commenter recommended that EPA revert to the simple, easy-to-understand Part 92 provision, and adopt the valuation method pioneered by the Federal Railroad Administration in the recently released crashworthiness rule, at 49 CFR 229.5. The commenter stated that with the statement that "A single existing locomotive cannot be divided into parts and combined with new parts to create more than one remanufactured locomotive" (§1033.640), EPA should be aware that it is commonplace in the railroad industry for parts from locomotives being rebuilt to lose their identities once the locomotives are stripped, and parts from one locomotive may well wind up on another locomotive. The commenter noted that it is rare for more locomotives to emerge from a rebuilding process than went in, because new underframes are not manufactured. The commenter suggested that EPA not word provisions such as this to allow interpretation to disallow traditional, and emissions-neutral, practices in the railroad industry. EMD commented that, regarding §1033.640(d)(1), EPA stated that "A locomotive with a used frame but all other parts new is a freshly manufactured locomotive because the frame value is less than 25 per cent of the total locomotive value." The commenter stated that EPA has really no way of knowing this in all cases, and recommended that this example be dropped from the rule. The commenter suggested that EPA simply allow the 25 per cent number to stand by itself, with adoption of the Federal Railroad Administration (FRA) method of calculating it.

The Texas Commission on Environmental Quality (TCEQ) commented that it believes that the emission standards for refurbished locomotives should be consistent with those applicable to remanufactured locomotives since the only real difference between these classifications is the amount of previously used engine components being exchanged. The commenter stated that it supports establishing emission standards that would require both refurbished and remanufactured locomotives to meet the highest tier of emission standards applicable to new line-haul or switch locomotives as appropriate at the time of the locomotive's refurbishment.

Environmental Defense, NRDC, et al. commented that they strongly share EPA's concern about locomotives that are refurbished, pollute at high levels, and elude protective emission standards. The commenters stated that they believe Congress intended to adopt a functional test to apply protective emission standards to new locomotives and new engines used in locomotives that are 'new' in the natural and ordinary meaning of that term. Conversely, the commenters noted, if locomotives or engines are functionally refurbished and not subject to protective emission standards, the core statutory protections and purposes of CAA Section 213 would be circumvented. The commenters further stated that EPA's leadership in applying protective emission standards to refurbished locomotives is critical in effectuating the statutory text and purposes of section 213 by securing vital protections for human health and the environment impacted by refurbished albeit high-polluting locomotives.

Environmental Defense, NRDC, et al. commented that they believe EPA's proposed definitional test is wide of the mark. The commenters noted that EPA proposed to adopt a rote economic replacement value test in determining whether a locomotive is refurbished. The commenters noted that they have vigorously opposed such applicability tests in other CAA contexts for their utter lack of nexus with the statutory text and purposes. (The commenters cited the rejection of a similar applicability test under the new source review program by the D.C. Circuit, which held that "the sort of ambiguity giving rise to Chevron deference is a creature not of definitional possibilities, but of statutory context." New York, et al v. EPA, 443 F.3d 880 (D.C. Cir. 2006).) The commenters stated that they supports EPA's general policy direction but oppose its proposed definitional change because of its strong potential to be under-inclusive in addressing significant locomotive refurbishments that are in fact functionally tantamount to a new locomotive.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
Environmental Defense, et al. OAR-2003-0190-0592.1
MotivePower, Inc. OAR-2003-0190-0613
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0551.1
Texas Commission on Environmental Quality (TCEQ) OAR-2003-0190-0612.1

Our Response:

We disagree with MotivePower's claim that refurbishing a locomotive (i.e., replacing 50-75 percent of the parts with new parts) would consistently lead to a service life that is as long as a freshly manufactured locomotive. Thus we are finalizing the proration factors as proposed.

While we do not agree with EMD's comments in detail, we do agree that the proposed regulations should be modified to be clearer. For example, we are clarifying that refurbishers may use the calculation methods specified by the FRA.

Finally, while we agree in spirit with the comments of TCEQ, ED, and NRDC, we believe that they need to be balanced against the need to avoid creating disincentives to refurbish older switch locomotives. Should the requirements applicable to refurbished switchers be too onerous, railroads would likely leave their switchers in the original higher-emitting configurations rather than update them to new technology that meets EPA standards. Thus, while the final regulations will subject most refurbished line-haul locomotives to the same standards as freshly manufactured locomotives, refurbished switch locomotives will continue to be subject to less stringent standards than freshly manufactured switch locomotives. As specified in §1033.640, refurbished switch locomotives will continue to be subject to the Tier 0 standards through 2014. After that, they will be subject to the Tier 3 standards. We believe that these standards properly achieve the greatest degree of emission reduction without creating a significant disincentive to refurbish.

4.1.11 Misfueling

What Commenters Said:

GE requested that the regulations be clarified regarding fuel and oil-related tampering and include additional measures to prevent misfueling. The commenter noted the proposed requirement of a label near the refueling inlet to say: "Ultra-Low Sulfur Diesel Fuel Only," and that EPA stated that misfueling would be considered as tampering under §1068.101(b)(1). GE commented that it is concerned that there is no statement in this regard in Part 1033 with respect to the misfueling of locomotives. The commenter also stated that, although it agrees with the statement in §1068.101(b)(1) that the use of incorrect fuel or engine oil may be "tampering," the language only applies if the fuel or oil renders the control system "inoperative." The commenter suggested that this be revised to state that misfueling is tampering even if the system is not rendered completely inoperative. GE noted the misfueling could partially damage the catalyst in a manner that could reduce its effectiveness over the long term so the standard cannot be met throughout the useful life, even if not rendering the catalyst completely ineffective immediately. The commenter noted that while it assumes that EPA intended the approach GE describes, the regulatory language could be read to require that the fuel completely destroy the catalyst immediately before the misfueling would be considered tampering.

GE commented that, to help address the lack of control currently in the fueling process, it is important for the rules to impose more specific requirements on the fuel suppliers and thus ensure that railroads can better manage fuel use. The commenter noted that the Locomotive Maintenance Officers Association (LMOA) Fuels, Lubricants, and Environmental (FL&E) committee will be setting up a study group by September 2007 that will be chartered to: develop a list of recommended analytical tests; recommend minimum testing frequency; develop standard reporting form for suppliers; request suppliers to provide fuel properties to the railroads the standard form; and recommend the use of a standard database. The commenter recommended that EPA consider the recommendations of this group and improve the protections against misfueling. Lastly, GE suggested that EPA revise §1068.101(b)(1) regarding tampering to clearly state that misfueling constitutes a tampering violation, whether or not the control system is rendered completely inoperative.

<u>Letters:</u>
General Electric Transportation (GE)OAR-2003-0190-0590.1

Our Response:

We state clearly in §1033.815 that owner/operators are required to use proper fuels, lubricant, and other fluids. Nevertheless, in response to GE's comments, we are adding an additional clarification that this requirement applies without regard to whether misfueling permanently disables the emission controls. Finally, we are willing to work with the LMOA in the future to develop better ways of eliminating misfueling.

4.2 Certification Issues

4.2.1 Certification Fees

What Commenters Said:

EMD submitted comments on certification fees and noted that while the certification fees rule is not part of this rulemaking, and therefore is not open for comment, it is not unprecedented for EPA to make required changes in unrelated rules as part of a rulemaking.

Letters:
Electro-Motive Diesel, Inc. (EMD)   OAR-2003-0190-0594.1

Our Response:

EMD correctly noted that this rulemaking does not deal with certification fees. We will, however, consider these comments in a separate rulemaking that does address certification fees.

4.2.2 Maximum Power and Useful Life Requirements

What Commenters Said:

EMD noted that the first paragraph of §1033.140 states that "rated power is used as maximum test power in Subpart F"; the commenter noted that the only mentions of rated power and maximum test power occur in §1033.520(c), which discusses power settings for locomotives with nonstandard notches or no notches. The commenter suggested that the language in §1033.140 specifically mention paragraph §1033.520(c). The commenter also stated that it believes that EPA should understand the difference between rated power and maximum test power on any given test. The commenter noted that maximum power depends upon test conditions (e.g., ambient temperature, barometric pressure, and fuel characteristics) and tolerances in the power measurement and feedback components of the locomotive control system. Lastly, the commenter noted that it is not possible in a locomotive to set the maximum power exactly at rated power.

EMD also commented that EPA's definition of brake power ("the sum of the alternator/generator input power and the mechanical accessory power, excluding any power required to fuel, lubricate, heat, or cool the engine or to operate aftertreatment devices") differs from the brake power definition common in the industry, which generally includes all power absorbed by the locomotive external to the engine, and would include the radiator cooling fans, but not the water or lubricating oil pumps, which are mounted on the engine and are driven by an engine internal gear train. EMD recommended that EPA revert back to the Part 92 definition of brake power.

EMD further commented that it believes that EPA's specification of minimum useful life in terms of megawatt-hours should be clarified and revised. The commenter noted that there are different types of power that are generally mentioned in discussion of locomotive power output and that the megawatt-hour meter that is part of the control system of modern locomotives (and required on certain locomotives by EPA) accumulates service in terms of one of the four power outputs; the commenter stated that it believes that the minimum megawatt-hour useful life of a locomotive configuration should be denominated in the same terms. The commenter stated that the reason for this argument involves certainty in determining where a locomotive is in its useful life, or whether it has exceeded it.

MotivePower suggested that tractive power be used for the purposes of calculating useful life. The commenter noted that in the rail industry rated power has traditionally been interpreted as tractive power; with current locomotive control technology, it is easier to record and monitor generator output (tractive power) versus engine output (rated brake horsepower). The commenter stated that it does not believe that this change will significantly impact useful life calculated values.

EMA noted that the NPRM proposed emission standards and requirements for marine engines less than 75 kW are based on the nonroad engine standards of Parts 89 and 1039, which will be effective as early as 2009 and were made in consideration of the fact that products are carried over from the nonroad segment to marine applications. Previously, these engines were all regulated under the same language (Part 89 for engines less than 37 kW) and, other than application and slight engine modification, contained the same general engine designs for operation and durability. The commenter noted that the NPRM proposed useful life requirements for these smaller products that are significantly different from the nonroad sector. The commenter stated that it believes that the significant difference between the current useful life requirements and the newly proposed requirements of the NPRM nullifies the durability research for the marine products, and does not allow for a smooth transition of design from the nonroad sector (and will force engine manufacturers to create two entirely different products rather than have a carry-over of clean engines from the nonroad sector). EMA suggested that the NPRM useful life requirements remain intact except for commercial requirements (see OAR-2003-0190, p.74), as there is some deviation that can be accommodated from the nonroad useful life periods to specifically account for marine applications. The commenter further stated that with the effective dates and standards as proposed in the NPRM these suggested requirements would not force separate product lines, nor would it prevent transition of compliant nonroad engines into the marine market.

EMA noted that §1033.101 proposed adopting an alternative useful life option for manufacturers and remanufacturers of locomotives with non-locomotive specific engines; however, the commenter noted, this allowance duplicates language in the current regulations which require that a petition for an alternative useful life must include the full rationale behind the request for a shorter useful life and supporting evidence. The commenter stated that it strongly supports the option for an alternative useful life for non-locomotive specific engines, but recommends that EPA provide specific guidance on this issue. Specifically, the commenter recommended that EPA clarify that it is acceptable to utilize useful life units equal to either equivalent nonroad or marine regulatory useful limits, or expressed in the same terms and equal to the published time-to-overhaul limits stated in the manufacturer's literature for the non-locomotive specific engines.

MTU strongly supports the option for an alternative useful life for these nonlocomotive specific engines, but strongly recommends issuance of a clear and concise guideline on the rationale that must be provided in order to receive approval. The commenter noted that available time-to-overhaul data may not be in the same time unit as stated for the minimum useful life.

Since non-locomotive specific engines are typically certified to either marine or nonroad standards, time-to overhaul data may be expressed in hours or years, not in megawatt hours or miles.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1 and OAR-2003-0190 0502, 0594.1, 0662
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1
MotivePower, Inc. OAR-2003-0190-0613
MTU DDC OAR-2003-0190-0573.1

Our Response:

We have revised §1033.140 and the definition of "brake power" to address EMD's comments. We have also revised the regulations to make the useful life requirement for engines under the new regulations the same as the currently applicable values. However, since EMA did not provide any new data for 37-75 kW engines, and there is no other evidence to support their claim that our current values are incorrect, we are not revising the useful life requirements for those engines. With respect to alternate useful lives for non-locomotive-specific engines, we agree to modify §1033.101(g) to be more consistent with the marine requirements. In response to MTU's comment, we believe that rebuild intervals expressed in hours can be converted to equivalent megawatt-hr values using good engineering judgment.

In response to MotivePower's comment, we will allow manufacturers to use tractive power for determining useful life. However, in all cases, the useful life must be based on the power measured by the locomotive's megawatt-hour meter. For example, if the megawatt-hour meter reads and records the electrical work output of the alternator/generator rather than the brake power of the engine, and the power output of the alternator/generator at notch 8 is 4000 horsepower, the minimum useful life would be 30,000 MW-hrs.

4.2.3 General Labeling Issues

What Commenters Said:

Regulatory construct: EMA commented that it strongly recommends that EPA consolidate a common labeling regulation similar to the previously consolidated common testing and compliance provisions into Part 1068. The commenter stated that there is an important need and opportunity for EPA to also eliminate the current obligation to provide information on the label which has limited value or utility, which no longer is relevant, and/or which can be provided by alternative means. EMA commented that it believes a common labeling requirement will: 1) eliminate the current existing confusion of having slightly different labeling requirements for different applications, 2) provide a uniform format, 3) enable manufacturers to more easily fit the needed information on the label in a manner which will provide greater flexibility for them to properly install labels on engines where there is ever more limited available space, and 4) could avoid the need for multiple part labels. The commenter further stated that this will also reduce costs to manufacturers and improve label clarity to inspectors, consumers, or anyone else needing access to label information.

Regulatory construct: EMD commented that they no longer believe that a common labeling regulation (so that all classes of power could have similar, or identical, labels) would be a large benefit to manufacturers. The commenter further stated that it does not encourage EPA to develop a common labeling regulation. The commenter stated that the major effort associated with labeling comes from the requirement, caused by the inclusion of the engine family name on the label, that the labels have to change every year. The commenter noted that this requirement causes new labels to have to be drawn every year, and parts lists to have to be changed to include the new labels. EMD commented that, as long as labels have to change every year, any common labeling regulation would have little benefit for its company.

Label variations: EMA commented that it is pleased with the inclusion of §1042.135(d) and §1033.135(d) in the NPRM allowing the emission label to include a reference to compliance with other standards. EMA commented that it supports the proposed provisions of §1042.135(f) and §1033.135(e) allowing manufacturers to apply for approval of modified labeling requirements. The commenter believes that this option will provide needed flexibility to manufacturers and help reduce the burden of meeting the new and revised requirements.

One-piece labels: EMA commented that it does not support the requirement that a label must be "attached in one piece so it is not removable without being destroyed or defaced" (§1042.135(b)(1)), as this would require that the label can only consist of one part. The commenter stated that it believes that it could be problematic if EPA retains all of the proposed labeling requirements, which are numerous, for engines greater than 19kW. The commenter noted that there is a limited amount of space on emission labels today, and an even more limited number of suitable locations on the engine where the label can be applied which comply with all of the requirements. The commenter strongly recommended that engine manufacturers have the option to use multi-piece labels if necessary.

One-piece labels: EMD urged EPA to modify the language of §§1033.135(b)(2)(i) and 1033.135(c)(2)(i) to allow labels to be made of more than one piece, provided that all pieces are attached to permanent locomotive parts, without the requirement that they be attached to the same part. The commenter noted that on older locomotives, the original manufacture date (a required item of label information) is on the builder's plate, which is riveted to the underframe on the exterior of the locomotive. The commenter stated that it believes that this location is less than optimal for the locomotive emissions label, because the paint, frequently having deteriorated in service, does not always provide a good surface for adhesion, and because the label is exposed to locomotive washing chemicals there. The commenter believes that a better location is inside the cab, at a position on the cab structure—and further, both the underframe and the cab structure are permanent parts of the locomotive, not subject to removal or change through the locomotive's life. EMD also requested that EPA amend Part 92 (§§ 92.212(b)(2)(iv) and 92.212(c)(2)(iv)) to modify the label attachment requirements to allow multiple-piece labels to be attached to permanent locomotive or engine parts, but not necessarily the same parts.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

Regulatory construct: We agree with EMA that some of our labeling requirements across engine programs have common elements and should be consistent. However, there are significant labeling requirements that are unique to each regulatory category we have established, such as: lawn mowers, trucks, and locomotives. As such, we believe these specific labeling requirements should be paired with the certification requirements established in each of the appropriate standard-setting parts. A common set of regulations for establishing consistent labeling requirements would need to include the same category-specific requirements that exist today, which would result in a complicated array of provisions. This may involve repeating regulatory text with similar information for different types of information or setting up a default labeling protocol with numerous variations for specific types of engines. Since most engine manufacturers produce engines in at most two or three different regulatory categories, it is not clear whether or not there would be any benefit to manufacturers by adopting a single labeling regulation due to the alternative complications that would arise from the complicated array of provisions that would make up such a unified regulation.

Instead, we have taken the approach of adopting parallel labeling requirements in each of the standard-setting parts. The plain-language regulations are set up to maintain a very high level of uniformity, both in organization and content. As a result, it should be very easy to look up the labeling requirements that apply for each regulatory category. Variations in label content or requirements are generally limited to those things that we believe are appropriate for each particular category. We would welcome ongoing attention to this issue, both to ensure that emission labels have the appropriate content and that requirements are harmonized across programs as much as possible.

With respect to the requirement for new labels every year, we have consistently (over time and across programs) maintained that engine labels should reflect the model year of the underlying certificate. This allows us to oversee the program and ensure that engines are properly certified. Similarly, annual labels help us to identify engines that are being sold with an inappropriate reliance on an expired certificate. For example, a manufacturer could certify an engine family in a given model year and not renew that certification in the following year. Without the model year information on the label, it would be very difficult to determine that these later engines are in fact not covered by a valid certificate.

Label variations: We are adopting the provisions supported by EMA related to alternate label language. We note too that we are adding a clarification to §§1033.135 and 1042.135 to specify that a statement regarding compliance with other emission standards (such as California or European standards) may be a separate statement, or it may be factored into a single statement for both EPA and other emission standards.

One-piece labels: Emission control information labels contain a unified set of information related to the compliance of a specific engine with certification requirements pertaining to that engine. Allowing manufacturers the discretion to spread information across multiple labels located on different parts of the engine carries certain risks; the information could be difficult to locate or could be divided in a way that makes certain portions of the label content more or less visible. We have allowed multiple labels in the past, and observed these types of problems which have led us to move away from this practice. For example, a problem observed in past enforcement cases involved a two-part label in which the compliance statement was isolated from the other identifying information; such a division would increase the risk of removing that portion of the label and applying it to a noncompliant engine.

We believe all locomotive and marine diesel engines have sufficient space available to accommodate the required information. That said, we do provide for omission of label content in special cases where there is not enough space for it. We already require one-piece labels for almost all regulatory categories, and are moving to make the requirement for one-piece labels as broad as possible. Given our desire to adopt parallel labeling requirements in each of the standard-setting parts, and the flexibilities we will offer for situations when this isn't possible, we are adopting the requirement for one-piece labels also for engines below 19 kW.

We are, however, finalizing a special allowance for Tier 0 locomotives to use multi-part locomotive labels, since the locomotives were originally produced before emission regulations started to apply and already included labels that included some but not all of the required information such as (manufacturer and build date).

4.2.3.1 Labeling—Locomotives

What Commenters Said:

EMA suggested that the new heading proposed in §1033.135(c)(2)(iii)(A) eliminate the word 'Engine,' so that the heading states 'Emission Control Information'. The suggested EMA heading will more accurately represents the information being conveyed by the label. It will also make the label easily identifiable on the engine and it will be consistent with the heading requirement in other applications.

EMA commented that it recommends that the requirement to state an engine's useful life (§1033.135(c)(2)(iii)(E)) be deleted in its entirety, as it provides no value to the consumer and is information which can be more readily found elsewhere.

EMA commented that it believes there is a conflict relating to the engine labeling requirements listed in §1033.135(c)(2)(iii)(F) with respect to standards/FEL for engine remanufacture requirements in cases where the engine and locomotive are certified to different standards.

EMA noted that the information required by proposed §1033.135(c)(2)(iii)(G) is more appropriately found in an alternative source, such as the owner's manual and does not belong on the emission label, so it suggested that this requirement be deleted.

EMA recommended that the requirement proposed in §1033.135(c)(2)(iii)(H) be eliminated, as it does not believe that information on critical operating specifications does not belong on an emission control label. The commenter stated that information of this type can be often be too complex and detailed to be accommodated on an emission label, and this information can be included in the owner/operator's manual (the more logical place for information of this nature).

EMD asked that EPA modify §1033.135(b)(2)(i) (which specifies that locomotive emissions labels may be made up of more than one piece, provided that all pieces are attached to the same locomotive part) to allow labels to attached to different permanent locomotive parts. On older locomotives, the original manufacture date, a required item of label information, is on the builder's plate, which is riveted to the underframe on the exterior of the locomotive. This location is less than optimal for the locomotive emissions label, and a better location would be inside the cab. EMD also asked that EPA this for the engine labels.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

In general we agree with EMA's comments related to the requirements of §1033.135(c)(2)(iii)(G) and (H) and have eliminated these as requirements. However, we disagree with EMA's other locomotive comments.

We disagree with EMA's comment that we should not require the word "Engine" on the engine emission label. We included this requirement in the earlier regulations to ensure that installer do not confuse the emission control label for the engine with the one for the locomotive.

We recognize that it may be appropriate to allow the word to be left off the label for non-locomotive-specific engines used in locomotives. Manufacturers may request our approval to do so under §1033.135.

We continue to believe that it is important for the useful life to be on the label because it has important implications with respect to preemption of state and local regulations. EMA provided no basis for a belief that this requirement is burdensome.

EMA's comment regarding the inclusion of FELs results from a misunderstanding of the regulations. The engine and locomotive cannot be certified to different emission standards, and thus, there can be no conflict.

We agree with EMD that Tier 0 locomotives originally labeled before our regulations applied should be allowed the flexibility EMD requested for locomotive labels, and have revised §1033.135(b)(2)(i). However, we see no reason why this flexibility is needed for labels on newer locomotives or for engine labels.

4.2.3.2 Labeling—Marine Engines

What Commenters Said:

Label heading: EMA commented that it prefers the new heading proposed in §1042.135(c)(1) because it more accurately represents the information being conveyed by the label. The commenter stated that it believes this change makes the label easily identifiable on the engine and it is consistent with the heading requirement in other applications.

Identifying limited applications—label: EMA recommended that the requirement in §1042.135(c)(9)—the requirement of including on labels the application to which an engine family is certified—be eliminated. The commenter stated that it believes this requirement is unnecessary and provides no value. The vessel manufacturer and customer know what type of engine they are purchasing. If EPA is interested in knowing what type of engine is installed in the equipment, it is easy enough to identify by contacting the engine manufacturer.

Identifying limited applications—certification: EMA commented that it believes the provisions of proposed §1042.205(v) add unnecessary confusion and uncertainty as to what the engine manufacturer actually is responsible for. The commenter stated that it believes the engine manufacturer's responsibility should be limited to informing the vessel builder of any limitations regarding engine application by complying with the provisions of §1042.135(c)(9). The commenter noted that it believes requirements of proposed §1042.205(v) are already covered by the labeling requirements of §1042.135(c)(9), and therefore §1042.205(v) should be revised. The commenter suggested that EPA change the wording to only require the manufacturer to explain how incorrect use shall be prevented if the labeling requirements of §1042.135(c)(9) are waived.

Identifying applicable emission standards: EMA commented that it opposed the requirement of proposed §1042.135(c)(4) that manufacturers must 'State the engine's category, displacement (in liters or L/cyl), maximum engine power (in kW), and power density (in kW/L) as needed to determine the emission standards for the engine family.' The commenter noted that engine category and power density information can be readily obtained from the application for certification and/or EPA's Certification Database, as can specific information on engine displacement (if this information is not already embedded in the engine family name). The commenter also stated that maximum engine power can be obtained by use of alternative means, such as a reader, which will confirm if a certified rating has been downloaded into the Engine Control Module (ECM). The commenter noted that ECMs of current electronic engines generally have the capability to store more than one certified rating, allowing the vessel owner/user to switch between certified ratings. EMA further noted that, because different rating calibrations can and often are downloaded to the ECM, the maximum engine power level shown on the label may not match the rating that is currently active in the ECM. The commenter stated that in those rare cases where there is an enforcement need to determine the maximum engine power level of a specific engine, this can be done by directly querying the ECM or by contacting the engine manufacturer.

Date of manufacture: EMA commented that it strongly objects to the proposed requirement in §1042.135(c)(6) to stamp or engrave the date of manufacture on the engine, if it is not stated on the emission label. EMA recommended that engine manufacturers be given the option to show the date of manufacture on the label, stamp/engrave it on the engine, or maintain a record of the engine manufacture dates (which can be made available by the manufacturer to the Administrator upon request). The commenter stated that it believes that allowing for multiple options is consistent with other applications and provides manufacturers with the flexibility to pick the option that makes the most sense for their business.

Identifying emission control systems: EMA and EMD object to the requirement in §1042.135(c)(8) to identify the emission control system with names and abbreviations consistent with SAE J1930. EMA stated that it does not believe there is any value added in having this information on the label, as the consumer will not necessarily be aware of what the abbreviations mean and/or care, and the requirement is unnecessary. The commenter noted that the emission control system is already identified on the application for certification and can be determined from an alternative source, such as the owner's manual. The commenter also stated that this additional information takes up space on the label and makes it even more difficult to comply with the requirement of having a single label. The commenter further noted that the recommended practice in SAE J1930 is limited to light-duty gasoline and diesel vehicles, and heavy-duty gasoline vehicles—which the commenter believes leads to the conclusion that this requirement is inapplicable for marine CI engines. The commenter noted that the NPRM contains language giving manufacturers the option to include the information required by this provision in the owner's manual if there is inadequate space on the emission label. The commenter stated that it believes this option gives strength to the argument that the information required by §1042.125(c)(8) is not critical information, since it does not absolutely have to be on the emission label.

Useful life: EMA recommended that the requirement at §1042.135(c)(12) to state the engine's useful life be deleted. The commenter noted that in the Omnibus Technical Amendment (70 FR 40420, July 13, 2005), the regulatory requirement to indicate 'useful life' on the emission label was amended to require the useful life be shown on the label only if it differs from the default useful life specified in the regulation. The commenter stated that it appears that EPA is reverting to the pre-Technical Amendment regulatory requirement to show useful life on the emission label. The commenter noted that all regulations, except those for Small SI engines, have a clearly established default value for useful life, so there really is no need to include specific useful-life values on the label. The commenter also noted that in cases where an engine manufacturer has certified an engine family with a shorter or longer useful life than the default value, the information can readily be determined from the application for certification and/or EPA's Certification Database. The commenter further stated that it does not believe that useful life information will provide any value to the consumer and when a regulatory authority requires this information, it can easily be found in the application for certification or in the US EPA Certification Database.

Fuel sulfur content: With respect to proposed §§1042.135(c)(10) and 1042.135 (e) requiring both the engine and vessel to have a fuel label, EMA recommended that the engine should not have to be labeled with a fuel information label if that information can be found in an alternative source. The commenter stated that the requirement to label both the engine and the vessel with a fuel-specific label is overly burdensome. The commenter also stated that it believes that requiring fuel information to be printed on the emission label is of little value to the consumer, because consumers will not be examining the engine to determine the type of fuel that should be used—the commenter believes that having the label be applied by the vessel manufacturer at the fuel inlet is more practical and accessible to the consumer. The commenter also stated that it does not make sense to impose a requirement on the engine manufacturer to provide a fuel label to the vessel manufacturer. The commenter noted that this requirement could add to the cost of the engine, and is an unreasonable burden. EMA commented that it feels strongly that the obligation to produce and apply the fuel information label required for the fuel inlet (§1042.135(e)) has to be on the vessel manufacturer, not the engine manufacturer. Lastly, the commenter stated that an engine manufacturer cannot ensure that the vessel manufacturer is labeling the vessel in accordance with the regulation and should not be held accountable for the actions of a party over which it has no control.

Fuel specifications: EMA also commented that it strongly recommends that the requirement in §1042.135(c)(11) to identify fuel and lubricant specifications be eliminated. The commenter noted that the NPRM contains language giving manufacturers the option to include the information required by this provision in the owner's manual if there is inadequate space on the emission label. The commenter stated that it believes this option gives strength to the argument that the information required by §1042.125 (c)(11) is not critical information, since it does not absolutely have to be on the emission label.

Duplicate labels: EMA commented that it does not support proposed §1042.135(g) requiring duplicate labels and recommended that this requirement be eliminated. The commenter stated that there are additional costs associated with producing duplicate labels, delivering the labels in a secure manner, and establishing the record-keeping requirements to keep track of the duplicate labels forwarded to vessel manufacturers. The commenter also stated that it believes that this opens the door to the fraudulent use of labels. However, the commenter noted that if this requirement is adopted, it believes that a provision should be added that absolves the engine manufacturer of any liability if duplicate labels are misused.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

Identifying limited applications—label: Engine families may include engine models certified using any number of the available duty cycles associated with specific marine applications. As a result, this engine-specific information is not available in the manufacturer's application for certification. We believe it would be inappropriate to be able to make this determination only by requesting the information after the engine has been installed on a vessel. For example, if an engine were installed in a vessel with a fixed-pitch propeller even though its certification was based on operation with a controllable-pitch propeller, we would have no basis for suspecting that the engine was installed improperly. Moreover, even if the engine were installed improperly, we would have no ability to evaluate the validity of a manufacturer's claim that the installation was proper.

A manufacturer could omit the label information related to specific applications by conducting additional tests to be able to market the engine for universal application. The incremental cost of running additional test points to be able to generate emission data for all the applicable duty cycles would not be very great. Manufacturers have rather pointed out that their calibrations are tailored to the specific applications to a degree that would prevent them from making their engines for universal use (either for compliance or performance reasons). If designs are matched to the marine duty cycles to the extent they can comply with emission standards, we believe it is entirely appropriate to identify these limitations directly on the engine.

We believe there is value in being able to identify the intended application of the engine from the label. It is important not only for us, but for vessel manufacturers, rebuilders, second owners and others to be able to readily determine the specific application for which the engine is designed and certified. This ensures that engines will be properly installed, rebuilt, and reinstalled in marine vessels throughout its lifetime.

Identifying limited applications—certification: As described above, we believe it is important for engine labels to identify the specific applications for which an engine is certified. We would want this information in the application for certification even if it is on the engine label. It is unclear why manufacturers would want to omit this information from the application for certification. Describing the range of applications for which the manufacturer is seeking certification adds no confusion or uncertainty. Aside from that, the proposal included a requirement that the manufacturer describe in the application what steps they will take to ensure that engines are installed in vessels consistent with any limitations that result from the method of certification. While it is important for the label to include this information, we believe manufacturers will need to take steps to communicate clearly to vessel manufacturers and others who order engines that certain engines may only be used in specific applications. We are therefore keeping the proposed requirements.

Identifying applicable emission standards: The current requirements in 40 CFR part 94 specify that manufacturers must identify the applicable emission standards (or family emission limits) and the per-cylinder displacement. The approach in this proposal involved identifying the engine characteristics instead of the emission standards. A complicating factor for the Tier 3 and Tier 4 standards is that differentiated emission standards in some cases apply based on maximum engine power and power density in addition to per-cylinder displacement. It is important that each engine have information on the label allowing us to identify the applicable emission standards. This helps with inspections, such as at importation, to confirm that the engine is appropriately certified. It would also help with in-use confirmatory testing, especially where we would be evaluating compliance with not-to-exceed standards using field-testing procedures. As a result, we are modifying the labeling requirements to allow manufacturers to either identify the applicable emission standards or to note the engine characteristics in sufficient detail to determine which standards apply.

We note that the labeling specifications allow manufacturers to identify a range of values for power, displacement, and power density. This should prevent any conflict or contradiction if an engine changes to a different certified configuration in the field. In fact, this serves as an additional reason why the engine should be labeled to identify the applicable standards (or engine characteristics for making that determination). Owners that change calibrations or make other engine modifications should understand that their ability to modify the engine is constrained by the underlying certification, which is fundamentally defined by the emission standards it is designed to meet. Modifying the engine in any way that would cause it to be outside of a certified configuration, including any limitations on power or other calibration settings, would be considered tampering.

It is true that applications for certification contain information related to the applicable emission standards and engine characteristics. However, the database with this information would consist of ten or more year’s worth of information from many manufacturers. There are times when an inspection or other determination would be unduly hampered by the time delay in accessing the information. We are in the process of automating the protocols related to certification. These improvements hold the promise of making this kind of basic information readily available from any device with Internet access. We will continue to monitor labeling requirements as we develop these other tools.

Date of manufacture: Under the Clean Air Act, engine certification is based on annual production schedules (or model years), where a manufacturer produces each engine during a production period such that it is covered by a valid certificate of conformity. Identifying an engine’s build date establishes clearly for each engine whether it is covered by a certificate of conformity for any given model year. Properly associating each engine with the appropriate model year is important for identifying applicable emission standards, calculating emission credits (where applicable), tracking emission-related defects, and executing a recall, among other things. We are in the process of adopting regulations that would further clarify the concept of build date, model year, and the effective dates of certificates of conformity in 40 CFR part 1068 for all nonroad engine categories. In the meantime, we believe each engine should be clearly identifiable with a certain model year based on its build date. Having this information recorded on the engine prevents a situation in which a manufacturer could manipulate records as needed to gain a more favorable outcome depending on the reported build date of any particular engine or engines. Our experience has shown that it is very difficult to contest a manufacturer’s claimed build date, even when it defies any customary business or manufacturing process. We also find it inappropriate generally to have to depend on manufacturers to provide information that is necessary to determine whether that manufacturer has committed a violation.

A further practical constraint comes from engine inspections, especially at importation where U.S. Customs and Border Patrol agents have limited time to evaluate large quantities of very diverse products. Inspection of engines often depends on knowing an engine's build date to establish which tier of emission standards apply. As described above, a straightforward inspection of an engine should allow an inspector to determine the applicable standards.

Having the build date on an engine would also provide a valuable piece of information, because the manufacturer makes a commitment in the assembly process by printing a specific date on the engine (generally month and year). This information is necessary for us to be able to evaluate whether an engine was produced before or after the effective date of a certificate of conformity. The printed build date information is unalterable, which is very effective for both compliance assurance (or prevention of noncompliance) and enforcement. For example, manufacturers would be very reticent to put a false date (such as a postdate) on an engine if there was a possibility that someone may inspect that engine shortly after the manufacturer introduces it into commerce and where it would be most evident that the date is in error. Likewise, if the printed date is substantially earlier than the actual production date, it may be possible to inspect associated records to evaluate the validity of the printed date (production records by serial number, build dates of equipment in which the engine is installed, invoices, bills of lading, etc.). Having the ability to demonstrate that an engine was produced after emission standards started to apply is essential both for our benefit to ensure compliance, and for the manufacturer's benefit to prove compliance.

Furthermore, where there is a compliance problem, it may be easier to demonstrate that a false build date is a violation than that the engine exceeds emission standards. By requiring build dates on labels, we are effectively requiring manufacturers to make a statement to the government, where criminal penalties apply if the information is demonstrated to be false.

We are adopting the requirement to print build dates on the label as proposed. This is part of a broader effort to adopt this requirement across engine categories.

Identifying emission control systems: We have experienced several enforcement cases in which an engine was introduced into commerce under a valid certificate, but was assembled without critical emission-related components. Without label information that makes it very easy to identify which emission-related components should be on the engine, an inspector would have little or no ability to evaluate whether an engine was built according to its certified configuration. By requiring label designs to be submitted at certification, we have each manufacturer's commitment to label the engine appropriately such that these inspections can occur with greater efficacy. Putting a mismatched label on the engine or building the engine inconsistent with its certified configuration would be an enforceable violation.

While engine owners generally do not need to know which emission-related components are on the engine, we believe rebuilders and remanufacturers do need to know. In fact, they should be using this information on the label to ensure that the engine is serviced properly and to ensure the engine is returned to its certified configuration if necessary. For example, identifying aftertreatment components on the label would prevent a high-volume engine rebuilder from inadvertently rebuilding an engine without including those aftertreatment components.

To the extent that SAE J1930 specifies terms and abbreviations that are incomplete or inappropriate for marine diesel engines, we would be ready to approve alternate labeling to ensure that labels appropriately communicate the relevant emission control technology information.

Useful life: It was an oversight in the proposal to require the label to include the useful life in all cases. We have modified the regulation in Part 1042 to align with Part 94, where we require the label to identify the useful life only if it differs from the default value, as noted in the comment. In cases where the useful life is in fact different than the default value, we believe this should be noted on the label, since there would otherwise be no reason to suspect that a different value would apply. Knowing the useful life is valuable for a variety of reasons, including identifying the scope of a potential recall and determining whether confirmatory testing should be performed on an in-use engine.

Fuel sulfur content: The long-term standards we are adopting are premised on the availability and the use of emission control technologies that depend on very low concentrations of sulfur in the fuel, such as catalyzed diesel particulate traps. We believe it is necessary to provide any fuel specification information imperative for proper operation and function of the engine on the emission control information label. This will ensure that vessel manufacturers will be made aware of the correct fueling needs for these engines. This information would also be essential for rebuilders and/or owners that employ swing engines or otherwise repower their vessels. This requirement will ensure that there will be no damage to any emission control technology installed on an engine through the accidental use of an incorrect fuel, such as that which would result if ultra low-sulfur fuel is required and not used.

We do not believe it is an unreasonable burden for engine manufacturers to send labels for vessel manufacturers to install at the fuel inlet. This secondary label is necessary for communicating to owners and operators that each refueling event should involve the appropriate fuel. We have written the final regulation to require engine manufacturers to take steps to ensure that vessel manufacturers apply these labels only if the engine manufacturer chooses to use instructions for the vessel manufacturer instead of sending the labels directly.

Fuel specifications: We agree that manufacturers should be able to rely on the owner's manual to communicate fuel-related specifications and provisions that are not related to fuel sulfur levels. We are not including this as a requirement in the final rule.

Duplicate labels: All EPA programs specify that the emission control information label must be readily visible after the engine is in its final installation. We have started to make a uniform accommodation across programs to address those situations where the vessel or equipment manufacturers are unable to install the engine without concealing the original label. We believe it is a reasonable burden for engine manufacturers to send duplicate labels when necessary as requested by the vessel or equipment manufacturer. We also believe the provisions in §1068.105 are adequate for preventing the misuse or proliferation of duplicate labels for fraudulent purposes. If engine manufacturers find additional ways to provide duplicate labels with a reduced risk of misuse, they are welcome to pursue that for their own practice and to suggest those as enhancements to the regulation in §1068.105.

4.2.4 Certification by Design

What Commenters Said:

With regard to the request for comment on whether owners/operators should be permitted to remanufacture locomotives to their previously certified configurations without submitting new emissions data (§1033.201(h)), AAR urged EPA to adopt this provision to facilitate competition in the remanufacturing marketplace and thereby help control remanufacturing costs. However, AAR commented that it does not agree with EPA that if such an option is offered, the owner/operator remanufacturer should have all the liabilities and responsibilities of a certificate holder. The commenter stated that it believes that if an owner/operator remanufactures a locomotive under this option and subsequently the locomotive fails to meet the required emissions levels due to a design defect in the certified configuration, then the entity that installed the design, not the owner/operator, should be liable for noncompliance. The commenter further stated that if the problem was with the design of the emissions system and not due to any action taken by the remanufacturer, it believes that holding the remanufacturer responsible would be unfair. (The commenter also noted that, in such an event, EPA would likely be taking action against the entity that installed the design in the first instance since there likely would still be locomotives for which that entity was responsible.) Accordingly, AAR suggested that the language of the last sentence be modified as follows: “You have all of the liabilities and responsibilities of the certificate holder for locomotives you certify under this paragraph, except that if the locomotive fails to meet a certified emissions level during its useful life due to a design defect in the certified configuration, the liability for failure shall lie with the previous certificate holder, not the owner/operator.”

With regard to the request for comment on whether an owner/operator should be allowed to recertify an already compliant locomotive upon remanufacture by design, EMD commented that it would support the proposed provision if the owner/operator recertifying the locomotive were able to assume responsibility for its emissions performance and assume the liabilities attaching thereto, but not if the liabilities were to fall on the original certificate holder. The commenter also noted that as parts are replaced and upgraded, it is unclear how an owner/operator would be made aware of such details in sufficient detail to assure that all locomotives are correctly remanufactured, while an OEM remanufacture system certifier can simply include in the remanufacture system all necessary components and software to assure a compliant, up-to-date configuration. EMD commented that if the liability were to fall on the original certificate holder, it believes EPA should require that the same brand-name parts or their replacements be used in the remanufactured locomotive, and not third-party ‘equivalent’ parts over which the original certificate holder has no control.

Letters:
Association of American Railroads (AAR) OAR-2003-0190-0566.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1

Our Response:

We continue to believe that it would be inappropriate to allow a railroad to obtain a certificate by design without accepting the responsibilities of a certificate holder. Therefore, we are finalizing the provision as described in the proposal.

4.2.5 Third-Party Components

What Commenters Said:

EMD commented that it believes that EPA should institute a procedure for approval of parts represented to be equivalent to OEM parts, and hold OEMs harmless from emissions standard exceedances caused by the use of non-OEM parts. The commenter also noted that EPA should be aware that there is an active aftermarket in emissions-critical parts for both locomotive and Category 2 marine engines, in which third-party suppliers sell replacement parts claimed to be equivalent to OEM parts; the commenter urged EPA to exercise control over the quality of parts used as replacements in such engines. The commenter noted that engine owners and operators typically buy OEM parts for the first couple of overhauls after a freshly manufactured engine or locomotive is placed in service, but the use of OEM parts tapers off, and parts used for in-service replacements often are made by third-party suppliers. The commenter noted that the OEM has no control over the quality or emissions performance of parts provided by third parties, and the use of such parts in the emissions-regulated environment exposes the OEM certificate holder to liability (since the OEM may have to perform an in-use test containing emissions-critical parts not of its manufacture and to diagnose the reason for any failure). The commenter noted that Part 92 currently says that EPA will hold the manufacturers and sellers of aftermarket parts liable for any in-use nonconformities attributable to those parts; however, the commenter expressed concern that there is not a parallel provision in the preamble or regulatory language of the new proposed rule. EMD suggested that EPA institute a program of qualification of third-party aftermarket parts in the regulatory language that includes the following elements:

- The program should be voluntary;
- If an engine user accepts in good faith a third-party vendor's assertion that a part is equivalent to an OEM part, and its presence engenders an emissions nonconformity, EPA's recourse should be to the part supplier, not to the user;
- A certificate holder that is called upon to perform an in-use test should have the right to exclude a locomotive or engine that contains parts not listed in the appropriate certification application, or not approved by EPA; and,
- In the case of an emissions test performed by others, a nonconformity of a locomotive or engine containing emissions-critical parts not listed in the certification application or not approved by EPA should not create liability for the certificate holder.

Chromium Corporation also requested the inclusion of the following concepts to prevent aftermarket suppliers from being regulated out-of-business by new proposed emission regulations:

- OEM's should take the primary responsibility for developing new engines and retrofit kits for existing engines that meet emission requirements. The OEMs should be the primary certificate holders.
- Just as aftermarket suppliers in the past have proven and guaranteed the suitability (usually considering performance, life, reliability and cost) of their parts or assemblies to their customers, they should be able to continue to participate in the aftermarket, adding emission requirements to the performance aspect.
- Each part or assembly should be evaluated individually as to the extent that it may affect emission performance of each of the regulated pollutants.
- It may be possible to demonstrate that a part or assembly does not affect emission performance (example: head sealing gasket in a power assembly) or that a part or assembly is physically and functionally identical to the kit part or assembly and is, therefore, equivalent and cannot adversely affect emission performance. These parts or assemblies should, as culmination of a simple request process, receive a Certificate of Part Equivalence from EPA. These aftermarket parts or assemblies can then be substituted into any kit without threat of the primary certificate holder denying responsibility for the remaining kit components.
- If a part or assembly is different than the kit part or assembly, it may be necessary to demonstrate emission performance of the affected regulated pollutants through appropriate, but simplified, cost effective testing.
- Once the test results establish acceptable emission performance (equivalence or better) of the aftermarket part or assembly, and this data is presented to and accepted by EPA as culmination of a simple request process, the part or assembly will receive a Certificate of Part Equivalence, the part or assembly can then be substituted into any certificated kit without threat of the primary certificate holder denying responsibility for the remaining kit components.
- Any failure of emission testing must be evaluated to determine cause and the responsible party shall assume responsibility for remedying the problem.
- OEM and other certificate holder should not be permitted to discourage the substitution of any aftermarket part or assembly as long as with it has a Certificate of Part Equivalence.

Chromium Corporation commented that it has developed several examples of how an aftermarket supplier might demonstrate part equivalence. The commenter encouraged EPA to resolve these issues that are very important to the company, as well as others who rebuild locomotive and marine engines, and have an interest in keeping their costs in control. The commenter also proposed that in addition to incorporating its requests into the rule, EPA should delay implementation of the proposed rule to 2010 to allow the aftermarket time to develop products and get appropriate Certificates of Part Equivalence in order to assure continued participation in the market.

Letters:
Chromium Corporation OAR-2003-0190-0651
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502

Our Response:

In response to these comments, we are adopting a component certification program as described in §1033.645.

In addition, as we stated in Chapter 6 of the Summary and Analysis of Comments document for the 1998 rulemaking:

> Any entity which is "engaged in the manufacturing or assembling" of a remanufactured locomotive is potentially liable for that locomotive's emissions performance. In general, EPA would expect to begin enforcement action against the certificate holder, since it is the entity that has the most control over all aspects of the design, certification and installation of a remanufacture system. However, in cases where the certificate holder is clearly not primarily responsible for a nonconformance, EPA would expect to hold the primarily responsible party liable in any enforcement action. For example, if locomotives were remanufactured under a certificate of conformity and were found to be in nonconformance in-use, EPA would pursue enforcement action against the certificate holder. If the remanufacture system were installed by an entity other than the certificate holder and the nonconformity was determined to be caused by improper installation, EPA would pursue enforcement action against the installer rather than the certificate holder, provided the certificate holder provided adequate system installation instructions with the system. Likewise, if an entity were to remanufacture a locomotive into a configuration not covered by a certificate of conformity, EPA would pursue enforcement action against that entity, rather than a different entity that may have simply supplied components for the remanufacture. Having authority to pursue enforcement action against any entity "engaged in the manufacturing or assembling" of a remanufactured locomotive allows EPA to directly pursue action against the entity most responsible for the problem. EPA would not use this authority to hold an entity liable for actions for which the Agency believes that it clearly has no knowledge of or control over.

We continue to believe this to be the appropriate policy for assigning liability for in-use nonconformity. The regulatory authority for this approach can be found in §1033.1(d). Thus, the component certification program should be seen as something that supplements rather than replaces this approach.

4.2.6 Engine Dressing

What Commenters Said:

EMD commented that many C2 engines are derivatives of rail engines, thus it enthusiastically supports harmonization of C2 marine engine standards with those for the locomotive engines from which they are derived. The commenter noted that locomotives comprise about 95 percent of the market for engines of this size, with marine engines making up most of the remaining five percent, and it believes there is little economic sense to design engines specifically for such a small market segment. In the spirit of harmonization, EMD urged that EPA remove the provision of §1042.605(f), which requires the submission of data obtained on the appropriate marine engine duty cycles for dressed engines certified under another rule, such as the locomotive rule. The commenter stated that it believes this paragraph removes the benefit of the dressing exemption to locomotive engine manufacturers, as satisfying its requirement would require running a separate test, generally in a different facility, as a locomotive cannot operate at many of the test modes and NTE points of the marine cycles.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502

Our Response:

This allowance is intended as an administrative flexibility to manufacturers. It is not intended to relieve them of their engineering responsibilities. Specifically, if an engine manufacturer is selling a locomotive engine for use in a marine vessel we expect them to know how its engine will perform in the vessel with respect to emissions. Thus, we are not dropping this requirement.

4.2.7 Infrequent Regeneration

What Commenters Said:

EMA commented that it believes that conceptually, the infrequent regeneration adjustment factor determination should be the same in all of the regulations relating to engine emission control systems that experience different emission characteristics during discrete planned events not fully contained within the normal emission testing cycle. The commenter noted that the calculation methodology described in the NPRM is acceptable but incomplete—the commenter believes that there is a significant concern with the determination of the frequency factor (F). The commenter stated that if the certification test cycle can be repeated back-to-back, in succession through a complete cycle of loading the diesel particulate filter (DPF) and regenerating the DPF, the cumulative emissions in terms of g/kw-hr can be calculated; however, if the regeneration strategy employed or the in-use operation characteristics of the engine are not consistent with the repetition of the certification test cycle, the determination of F is not defined. EMA commented that EPA should address this in the final rule.

EMD commented that, when adjusting emission levels to account for infrequently regenerating aftertreatment devices, it believes that applying adjustment factors to measured emission levels may be tricky depending on when the regeneration occurs during an emission test. The commenter stated that it would seem to make sense to disable regeneration during emissions testing to avoid having to try to apply proportional estimates of the effects on emissions collected during the regeneration period of that specific test. The commenter noted that this would not eliminate the need to measure and determine emissions rates in regeneration and in non-regeneration states for each test mode or test phase so that appropriate adjustment factors can be determined and applied; also required for this calculation is a determination of the frequency of occurrence of regeneration events based on operating data or running replicate tests. EMD recommended that EPA explicitly allow in this section disabling of regeneration on infrequently regenerating devices in order to streamline testing.

GE commented that it believes that the rule should not require upward adjustment of certification results to account for emissions during regeneration. The commenter noted that it was proposed that emission levels during certification and in-use testing be adjusted to account for the infrequent regeneration of aftertreatment devices (§1033.525). The commenter stated that it believes that the proposal for the emission standards, in particular, the Tier 4 PM limit, did not take into account the increased emissions that would occur during regeneration events. GE commented that in its review of the record, EPA did not include data from regeneration events and show that the Tier 4 PM limit can be met or perform any engineering analysis to suggest that this is the case. The commenter stated that EPA must have a basis for the level at which it sets the standard, even where such standards are technology-forcing, thus it believes that no upward adjustment should be required.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502
Engine Manufacturers Association (EMA) OAR-2003-0190-0545
General Electric Transportation (GE) OAR-2003-0190-0590.1

Our Response:

In general, we agree with the EMA comments, and are revising the regulatory text with respect to the determination of the frequency factor (F). With disagree with the comments arguing that we should drop this requirement. Discrete regeneration events can be important because it is possible for exhaust emissions to increase during the regeneration process. We expect that in many cases, the regeneration events would be sufficiently frequent to be included in the measured emissions. Nevertheless, this issue becomes a regulatory concern because it is also conceivable that these emission storage devices could be designed in such a way that a regeneration event would not necessarily occur over the course of a test, and thus be unmeasured by the current test procedure. Since these regeneration events could produce increased emissions during the regeneration process, it will be important to make sure that regeneration is captured as part of the certification testing. Therefore, we are finalizing the proposed provisions, which are essentially the same as already apply for other nonroad diesel engines.

4.2.8 Durability and Maintenance

What Commenters Said:

GE commented that it supports the ability to submit and obtain approval of a deterioration factor plan, but urged inclusion of a response timeframe to ensure certificates are issued in a timely manner. The commenter stated that with the proposal to add a requirement that manufacturers submit a Deterioration Factor (DF) Plan for EPA approval in advance of conducting engine durability testing or in advance of submitting the engine certification application (72 FR 15994), it is important that the manufacturer not be delayed in conducting the necessary tests to complete certification. The commenter suggested that if this provision is adopted, it must be accompanied by a 30-day time limit for EPA approval or rejection (and if a manufacturer does not receive a response from EPA within 30-days from receipt, the DF plan should be deemed approved).

EMA commented that it believes that the DF requirements for marine engines should remain as they currently exist, and that the proposed modifications will likely delay the certification process and potentially add significant and unwarranted costs. EMA noted that under the existing regulations for DFs (40 CFR §94.218(d)(1)), if the Agency takes exception to an element of the process, the Agency is entitled to a complete explanation and, in extreme circumstances, may issue a conditional certificate dependant on the exception being adequately justified or corrected. The commenter stated that this process has been in effect, and has worked, for many years in other regulatory contexts. The commenter further stated that it believes that the requirement of an advance DF approval will impose a significant burden on the Agency in the form of standardized approval criteria, uniform application, and generation of approval documentation. Regarding the proposal to define minimum DF data requirements (§1042.245(c)) and the new language requiring testing “at least three times with evenly spaced intervals of service accumulation”, EMA noted that manufacturers typically accumulate service time in one test cell and measure emissions in another for efficient resource utilization and each engine swap from cell-to-cell consumes valuable time and resources. The commenter suggested that emission measurements at two service accumulations should be allowed, and multiple tests at each accumulation point could be performed to ensure statistical significance to minimize downtime and enhance test cell utilization. The commenter also suggested the option that manufacturers be able to ‘establish a trend of changing emissions’ with multiple evenly spaced intervals if the engine deterioration characteristics warrant this approach. EMA also commented that it believes that the locomotive DF requirements should also remain as they currently exist in accordance with good engineering practices, and raised the same concerns and suggestions as stated for marine engines.

EMA requests that EPA apply the proposed provision in §1042.125(a)(4) for shorter maintenance intervals (which currently applies only to C2 marine engines) C1 engines as well. In addition, EMA requests that such a provision be added for locomotive applications as well.

EMD commented that it believes that EPA should not require minimum maintenance intervals for Category 2 engines (§1042.125); rather, it stated, the setting of those intervals should be left to the market. EMD commented that it presumes this was done to protect engine customers from manufacturers. The commenter stated that it believes this ignores the active nature of the Category 2 engine market, and the fact that this market is characterized by interaction between engine users and engine manufacturers. The commenter noted that such a market is "capable of efficiently setting optimal maintenance intervals without governmental assistance." The commenter also stated concerns with the notion of setting maintenance intervals for systems that are not yet designed. Lastly, the commenter stated that it believes that EPA's maintenance intervals may conflict with the intervals set by maritime classification societies, which set maintenance requirements by vessel class—which it believes could present an unsolvable problem to vessel owners and operators.

EMD commented that it believes that EPA has correctly noted that multiplicative deterioration factors may not be appropriate in cases where testing variability is greater than locomotive-to-locomotive variability. The commenter noted that while it has little experience with multiplicative deterioration factors, it is aware that manufacturers of nonroad and marine engines have pointed out to EPA on several occasions the difficulties that can be encountered in projecting deterioration to useful life when standards are low and testing variability is encountered. EMD stated that it appreciates the flexibility afforded by EPA in this paragraph.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502
Engine Manufacturers Association (EMA) OAR-2003-0190-0545
General Electric Transportation (GE) OAR-2003-0190-0590.1

Our Response:

While we understand GE's concern, we do not believe that it would be appropriate to include a 30 day time limit for DF approvals. Rather we expect manufacturers to submit their plans under §1033.210 sufficiently early to allow for full review.

In response to EMA's DF comments, we proposed to make the marine DF requirements the same as the requirements for other nonroad engines under Part 1039, except that we added a requirement to obtain preapproval. We continue to believe the preapproval process is appropriate, and it is unclear how starting the approval process earlier could result in delays. We have modified the regulations, however, to allow additional flexibility with respect to the number of test points and the spacing in response to EMA's comment.

With respect to EMD's comments on minimum maintenance intervals, we believe that §1042.125(a)(4), which allows us to approve alternate maintenance intervals, addresses their concern. We are also revising the regulations to apply this provision to Category 1 engines, as well. We are not applying it to locomotives because we do not specify any maintenance intervals for locomotives.

4.2.9 Auxiliary Emission Control Devices (AECDs)

Note that comments related to AECDs for locomotives that operate in Mexico are summarized in section 4.1.6 above, and comments related to AECDs for SCR systems are summarized in section 4.5.

What Commenters Said:

EMA noted that the requirement of safe operation is an overriding consideration for marine propulsion engine systems, and pertains to all applications. The commenter stated that for the applications covered by the NPRM, EPA's assessment of acceptable AECDs must place particular emphasis and priority on allowances that are tailored to ensure safe engine operation. The commenter stated that it believes that special clarity in the language covering AECDs is therefore needed to help guide EPA staff in evaluating applications for AECDs that stem from considerations of safe and durable engine operations in certain extreme environments. The commenter requested the inclusion of language to guide EPA staff, who may not have expertise in the special requirements of the marine environment, to make the often difficult judgment of the necessity of a particular AECD approach. The commenter also suggested that the language have additional assurances to manufacturers that approaches to address the difficult marine applications will get the proper consideration. The commenter stressed that AECDs that may address extremely rare occurrences must still be given proper weighting for safety concerns.

Letters:
Engine Manufacturers Association (EMA) OAR-2003-0190-0545

Our Response:

As noted in section IV.A (15) of the preamble we are continuing our general regulatory requirements related to safety. We agree with EMA's comment that safety is important, but do not believe that additional specific language would be appropriate and may even be problematic. It is more appropriate to rely on the existing approach, which is sufficiently flexible to address these concerns.

4.2.10 Other Certification Issues

4.2.10.1 VERIFY Certification System

What Commenters Said:

EMD commented that it believes that the VERIFY system should be modified to allow inclusion of as many sets of test data as are necessary to show conformity to standards of all engine family members. The commenter noted that §1033.225(b)(3), which specifies information needs for amending locomotive certification applications, may lead to the necessity of submitting more than one set of data to support a certification application; however, the VERIFY system, under which locomotive certification is currently carried out, has room for only one set of test data.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502
Engine Manufacturers Association (EMA) OAR-2003-0190-0545
General Electric Transportation (GE) OAR-2003-0190-0590.1

Our Response:

We will modify the VERIFY system as appropriate to accept all required information.

4.2.10.2 Joint Freshly Manufactured and Remanufactured Engine Families

What Commenters Said:

EMD also recommended extending the period during which freshly remanufactured and remanufactured engines can be included in the same family to six years after the onset of a new Tier (rather than the proposed five year period), as the normal overhaul period for line haul locomotives is six to seven years. The commenter noted that it welcomes this flexibility on EPA's part, as it avoids the necessity on the part of the manufacturer to institute a new engine family, with a separate certification activity, to accommodate the relatively few locomotives that require remanufacture due to major engine failure before the normal overhaul period. In its comments, EMD requested that EPA make the following change to Part 92: allowing the inclusion of remanufactured engines in the same family as new engines for the first years of a new Tier of standards, as proposed in §1033.230(f). (The commenter also noted that it has suggested extending the five years proposed to six years; any Part 92 provision should parallel the final Part 1033 provision.)

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502
Engine Manufacturers Association (EMA) OAR-2003-0190-0545
General Electric Transportation (GE) OAR-2003-0190-0590.1

Our Response:

We agree and are revising the regulations accordingly.

4.2.10.3 Exhaust Sampling Ports

What Commenters Said:

EMA noted that the current marine engine regulations contain a provision for the installation of an exhaust gas sampling port (§94.7(d)), but stated that the NPRM does not spell out a similar requirement. The commenter noted that current marine engines rated less than 37 kW are regulated under Part 89 and contain no similar requirement; and further that the NPRM and Part 1042 (new regulatory section covering all marine engines), it is unclear whether the requirement for the installation of an exhaust sampling port will apply. EMA requested that EPA clarify whether this requirement will apply or not.

Letters:
Electro-Motive Diesel, Inc. (EMD)   OAR-2003-0190-0502
Engine Manufacturers Association (EMA)   OAR-2003-0190-0545
General Electric Transportation (GE) OAR-2003-0190-0590.1

Our Response:

Consistent with the regulations for general nonroad engines in Part 1039, this requirement is now located in §§1042.130 and 1042.205.

4.2.10.4 Reporting CO_2 Emissions

What Commenters Said:

EMA stated that the requirement to report carbon dioxide (CO_2) emissions if measured during certification testing will impose an additional burden on certification testing and should be optional if not measured.

Letters:
Electro-Motive Diesel, Inc. (EMD)   OAR-2003-0190-0502
Engine Manufacturers Association (EMA)   OAR-2003-0190-0545
General Electric Transportation (GE) OAR-2003-0190-0590.1

Our Response:

It is important to note that this provision does not require the measurement of CO_2, merely the reporting of already measured values. We disagree that merely reporting CO_2 is a significant burden.

4.2.10.5 Effect of Calculation Methods on Engine Family Designations

What Commenters Said:

GE commented that it believes EPA should clarify that §1033.230 allows manufacturers to define engine families consistent with system efficiency and other features that might be present on a locomotive. GE commented that it is important for the final rule to give manufacturers the ability to take credit in duty cycle and certificate calculations for features that reduce emissions, such as throttle/speed management, load control, automatic engine stop/start (AESS), hybrid, and other features. The commenter suggested that EPA clarify that §1033.230

does not prohibit establishing an engine family based on the presence (or lack thereof) of these features.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502
Engine Manufacturers Association (EMA) OAR-2003-0190-0545
General Electric Transportation (GE) OAR-2003-0190-0590.1

Our Response:

We agree and are revising the regulations accordingly.

4.2.10.6 Reasonable Cost Limits for Locomotive Phase-In

What Commenters Said:

GE commented (with respect to proposed §1033.150 that the Tier 0 and Tier 1 standards would only apply prior to 2010 if kits are available at a "reasonable cost"—an incremental cost to the railroad due to meeting the new standards (including initial hardware, increased fuel consumption, and increased maintenance costs) during the useful life of the locomotive less than $220,000 and initial incremental hardware costs less than $125,000) it agrees that the early implementation of kits should be promoted in the rule. The commenter also stated that it agrees that kits should only be required to be purchased if they are available at a reasonable cost. However, the commenter believes that EPA's proposed reasonable cost values are too low, and need to be increased to levels that reflect what the kits are likely to cost manufacturers to provide incentives for early introduction. GE noted that the $220,000 life-cycle cost also could not reasonably be expected to cover the increased fuel cost that will be associated with these kits. The commenter stated that one of the kits it expects to introduce will likely involve a 3-4% fuel penalty to achieve compliance with the new standard—which alone could exceed the $220,000 cost based on current fuel prices (assuming that fuel prices remain stable).

GE also asked that EPA clarify in the final rule the year on which the dollars values listed are based, and that EPA clarify that there is an adjustment for inflation each year between introduction and 2010. The commenter stated that its view of the reasonable cost provisions could change depending on whether the $220,000 is based on 1990 dollars, consistent with other programs under the Clean Air Act, or if it is based on 2007 dollars. AAR submitted a supplemental comment recommending a methodology to adjust the values.

EMD commented that the requirement that in 2008 and 2009 a person or entity remanufacturing a locomotive must apply a kit to meet the new Tier 0 and Tier 1 standards if such a kit is available at a "reasonable cost" (and for Tier 2 locomotives in the years 2008 through 2012) is likely to limit the availability of kits and hamper manufacturers' ability to deliver the emissions reductions desired by EPA. The commenter stated that it is impossible to define the reasonable cost of unknown solutions—at this time, it is not known exactly what will be required to meet the new standards. The commenter further noted that if the cost of the hardware to meet the standards exceeds the proposed reasonable cost, the availability of a kit will be postponed until 2010, or until 2013 for Tier 2 locomotives. The commenter suggested that EPA allow market forces to work, rather than artificially setting reasonable cost.

AAR commented that while it does not object to the concept of accelerating the timing of the new Tier 0/1 standards if certified system is available at a reasonable cost, additional protections need to be built in. AAR commented that it should not be sufficient that a remanufacturer merely alleges that it can offer a certified system at a reasonable cost—the commenter noted that there are a variety of entities that could seek to be remanufacturers and EPA cannot assume that any entity seeking to be a remanufacturer has ensured technical feasibility. The commenter recommended that there be a process by which a railroad or another entity, other than the remanufacturer, can provide EPA with information as to the true cost of a remanufacture system, technical feasibility, and other pertinent information. AAR also suggested that if a remanufacturer files an application for certification under this section, EPA should commit to publishing a notice of the filing in the Federal Register and provide interested parties an opportunity to comment (and only including information that was not confidential). The commenter stated that it believes that a Federal Register process would provide railroads and others with a fair opportunity to comment on whether a proposed system was truly feasible.

Letters:
Association of American Railroads (AAR) OAR-2003-0190-0566.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502
Engine Manufacturers Association (EMA) OAR-2003-0190-0545
General Electric Transportation (GE) OAR-2003-0190-0590.1

Our Response:

We agree that the costs should be adjusted for inflation and have revised the regulations in that respect. We have also revised the regulations to clarify that the fuel (and other operating costs) include only those costs incurred during a single useful life period. We believe that these changes address GE's primary concern.

While we have revised the cost limits slightly based on our current cost analysis, we do not agree that these values should be substantially higher. Our intent with this provision was to create an incentive to bring the most cost-effective designs to market first.

We agree with AAR that remanufacture system certifiers need to do more than allege that their systems perform adequately and are being made available at reasonable cost. In order to achieve certification, a system must meet all relevant requirements under Part 1033, including testing according to EPA-specified criteria and methodology. Likewise, the reasonable cost showing must conform to EPA criteria in Part 1033, including changes we have made to the proposed requirements in response to AAR requests for clarification and strengthening. We disagree with the AAR comment that we need a formal process to address potential railroad concerns. However, we are adopting two new provisions that address AAR's concerns. First, we are requiring applicants seeking early certificates to notify their customers when they submit the application. Second, we are limiting the total number of remanufactured locomotives that could be subject to the new standards in 2008 and 2009. We believe that these provisions will allow the railroads to have significant influence over the process and discourage remanufacturers from certifying unreliable systems. Nevertheless, should the railroads believe that an applicant is attempting to certify an unreliable system, we would not ignore their technical input, even without a formal process.

4.3 Emission Credits and Incentives

In addition to the specific comments discussed here, we also received comments supporting our ABT program in general.

4.3.1 Credits From Part 92 for Locomotives

What Commenters Said:

EMD commented that it does not understand why EPA has stated that PM credits generated under Part 92 may not be used under Part 1033, and it urged EPA to delete this provision and allow the use of Part 92 PM credits under Part 1033 without restriction. The commenter stated that this in an inconsistency with the preamble language which says that only credits generated by Tier 0 and Tier 1 locomotives may not be used, presumably leaving open the possibility of using PM credits generated by Tier 2 locomotives. The commenter stated that it does not understand this because it would otherwise encourage manufacturers to use up any PM credits that they might have banked, rather than saving them for future needs and possibly never using them—using the credits would increase overall PM emissions. The commenter also stated that it believes this measure discourages bringing locomotives under Part 1033 (for example by the early introduction of remanufacture systems meeting the Part 1033 standards), making this measure is contrary to EPA's desire for early and rapid inventory reductions. EMD commented that the justification in the preamble paragraph that PM credits generated by Tier 0 and Tier 1 locomotives are 'windfall credits' is faulty; the commenter noted that Tier 0 and Tier 1 locomotives generate PM credits against a lower maximum value of the standard term to be used in the credit calculation equation (not against the respective standards), and therefore, the matter of windfall credits has already been taken care of in the earlier rule. The commenter noted that PM credits have been the most difficult to generate, precisely because of this provision. Lastly, the commenter stated that credits that have been generated under Part 92 are the property of the certificate holders that generated them, and were generated at a cost; the commenter believes that for EPA to 'demonetize' these credits in this manner constitutes a taking of property, and it believes that the owners should be compensated for this.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1

Our Response:

We have reconsidered our concern regarding the potential for PM credits generated under Part 92 to be windfall credits. The fact that Tier 0 and Tier 1 credits are calculated relative to our estimate of the average uncontrolled baseline does largely prevent manufacturer from obtaining significant windfall credits. Thus, after reconsideration, we no longer believe it would be appropriate to prohibit the use of Part 92 credits in the new program.

4.3.2 Tier 4 Locomotive Credit Restrictions

What Commenters Said:

Regarding the request for comment on whether credit caps should be lower for Tier 4 locomotives (under the current regulations, certified emissions limits for a locomotive using credits cannot exceed the limits for the previously applicable standard), AAR commented that it would not support such a provision. The commenter stated that it believes that a lower cap would not have a positive effect on emissions, since a credit holder could simply apply the available credits to more locomotives (though the commenter recognized the fact that EPA is proposing that credits could not be applied to more than 50 percent of a manufacturer's annual Tier 4 production). The commenter also stated that the purpose of a credit program is to provide incentives, and that it believes that the more credits are limited, the less useful the credit program becomes.

With regard to the request for comment on whether FEL caps should be set for Tier 4 locomotives lower than the Tier 3 standards, EMD commented that it does not support this. The commenter stated that it believes that doing so would have little functional effect, as emissions from aftertreatment-equipped locomotives are highly likely to be significantly lower than the Tier 3 standards, even if they do not meet the Tier 4 standard. The commenter also stated that credits are likely to be used up rapidly anyway, as they will be increasingly difficult to accrue as the new Tier 0, Tier 1, and Tier 2 standards come into effect; and noted that "a megagram of emissions is still a megagram" regardless of it is used on one locomotive with a high FEL or on several with lower FELs. The commenter noted that it will likely be argued by others that Tier 4 FEL caps should be set low to protect extreme nonattainment areas, but the commenter believes that these arguments miss the fact that the fleet average or usage agreements negotiated by railroads with the air quality authorities in such areas ignore the effect of credit programs and only take into account the stack-out emissions of the locomotives. The commenter thus stated that using high-emitting locomotives in such areas handicaps the railroads because they would have to use fewer locomotives than they would have otherwise, rendering the matter of where FEL's are set emissions-neutral in extreme nonattainment areas subject to such agreements.

Regarding the proposal to carry over the averaging restriction that applied to Tier 2 to the Tier 4 locomotive fleet, such that the number of Tier 4 locomotives that may be certified using credits must be less than 50% of a manufacturer's annual production, GE commented that it believes this structure worked well for Tier 2 and should be continued. However, the commenter noted that given the significant challenge of achieving the Tier 4 NOx limit, it believes that EPA should allow an initial period during which credits could be used for more than 50% of the fleet to address potential supply chain issues or problems with the urea infrastructure early in the program.

Letters:
Association of American Railroads (AAR) OAR-2003-0190-0566.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
General Electric Transportation (GE) OAR-2003-0190-0590.1

Our Response:

We continue to believe that the proposed credit restrictions for Tier 4 locomotives are appropriate and are making no changes. This is the approach EMD requested, and is generally consistent with GE's comment. We disagree with GE request to relax these credit restrictions at the start of the Tier 4 program. We believe that the other flexibilities at the start of the program are a more appropriate way to address this concern.

4.3.3 Cross-Cycle Locomotive Credit Exchange

What Commenters Said:

GE commented that it believes that EPA should not allow cross-cycle credits for Tier 3 and Tier 4 units unless it can provide for simplified tracking and assure compliance. The commenter stated that it believes credits generated on switchers should not be allowed to be used on line-haul units or vice versa for Tiers 3 and 4, as it believes that, in the switcher market there is the potential for multiple certificate holders that do not participate in the line-haul market. The commenter raised the concern that this could create a two-OEM/one-user situation that will be very difficult to track and monitor.

MotivePower, Inc. requested that the restriction on cross-cycle credit trading be removed from §1033.740. The commenter stated that it believes that lifting this restriction will create greater economic value for ultra-clean locomotives operating on the switch cycle, such as the multi-engine locomotive, and will encourage a faster turnover of the aging switcher fleet. The commenter noted that switchers are generally at the bottom of the maintenance and replacement schedule (for economic reasons) and the only way to encourage turnover of the switcher fleet is to increase the economic value of new and cleaner technologies, and allowing cross-cycle trading of credits generated on the switch cycle would help to do this. The commenter stated that it believes that concerns that a windfall of line-haul credits could be created by allowing cross-cycle trading are unfounded, the commenter noted that emission credits are a function of the locomotive's rated horsepower and the difference between the standard and the FEL. The commenter further noted that switchers are, by definition, limited to a maximum horsepower of 2300 and will thus generate fewer credits than line-haul locomotives that have higher horsepower. However, the commenter suggested that EPA could limit the useful life of a switcher locomotive eligible to generate cross-cycle credits to seven years, or 70% of the current useful life in megawatt-hours, to assure a credit windfall is not created by allowing cross-cycle trading.

Letters:
General Electric Transportation (GE) OAR-2003-0190-0590.1
MotivePower, Inc. OAR-2003-0190-0613

Our Response:

There are two different set of issues associated with cross-cycle averaging. The first involves issues associated with allowing credits generated by line-haul locomotives to be used by less clean switch locomotives (and vice versa). In this regard, EPA had some concern about the use of credits generated by line-haul locomotive being used to produce new switch locomotives with emissions above the Tier 3 standards. This is because switch locomotives are often concentrated around urban areas. We proposed to prohibit this, and continue believe that prohibition is appropriate. However, we agree with MotivePower's comment that there is little reason to be concerned about the use of switch credits by line-haul locomotives and are allowing it.

The second set of issues are due to a feature of the Part 92 ABT program, in which credits are segregated based on the cycle over which they are generated but not by how the locomotive is intended to be used (switch, line-haul, passenger, etc.). This feature will continue for Tier 2 and earlier locomotives. Under these regulations, line-haul locomotives can generate credits for use by switch locomotives, and vice versa, because both types of locomotives are subject to the same standards. However, for the Tier 3 and Tier 4 programs, switch and line-haul locomotives are subject to different standards with emissions generally measured only for one test cycle. As described in the preamble, we are finalizing special provisions to make this approach work without double-counting of credits.

4.3.4 Locomotive Credit Transfers

What Commenters Said:

With regard to the request for comment on whether it would be more appropriate to require that credits generated by the production and placing in service of a locomotive (whether freshly manufactured or remanufactured) be transferred to the railroads in some or all cases, EMD, MotivePower, and GE commented that such transfers should be voluntary (as is the case in the existing regulations) rather than mandatory.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
General Electric Transportation (GE) OAR-2003-0190-0590.1
MotivePower, Inc. OAR-2003-0190-0613

Our Response:

We agree and will not mandate such transfers.

4.3.5 Restricting Marine Credits By Category and Application

What Commenters Said:

EMA noted that the proposed ABT provisions at §1042.701(c) would allow the use of credits generated by recreational marine engine families to be used by Category 2 marine engine families, which is currently prohibited under §94.304(k)(3). The commenter stated that §1042.701(c) allows greater flexibility for the use of recreational marine engine emission credits, and it supports this increased flexibility; however, the commenter recommended and requested that the final rule include this same flexibility for Category 1 engine families as well. The commenter noted that Category 1 and Category 2 engines compete in certain of the same power ranges, and believes this additional flexibility provision is necessary to ensure that Category 1 engine families have an equivalent and equitable opportunity to make use of recreational marine engine generated credits. The commenter raised the concern that Category 1 engine families could otherwise be at an unfair regulatory disadvantage when compared with Category 2 engines in similar power ranges. EMA also recommended that the 25% discount be removed from the credit calculations, since the useful life of marine engines is already included in the credit calculation (and thus there is no need to apply a further discount to recreational marine engine emission credits); the commenter recommended the following change to §1042.701(d) to reflect this: "(d) Emission credits generated by recreational or commercial Category 1 engine families may be used for compliance by Category 1 and Category 2 engine families."

Cummins Inc. also noted that the proposal allows credits generated by recreational marine engines to be used by Category 2 commercial engines but not by Category 1 commercial engines. Cummins stated that (as outlined in EMA's written comments) it does support the minor changes to the ABT program that expands the allowed use of these credits to Category 1 commercial engines. The commenter believes that Category 1 and Category 2 engines that compete in the same power ranges should be given an equal opportunity to utilize emission credits, and recommended that EPA adopt the language proposed by EMA.

Letters:
Cummins Inc. OAR-2003-0190-0559.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0545

Our Response:

The allowance to exchange credits between recreational and commercial marine engines was included in the proposed regulations by mistake and is not being finalized. We continue to believe that differences between recreational and commercial engines, especially those related to useful life and usage patterns, are too great for us to have confidence that we could accurately balance the credits.

4.3.6 Alternate NOx+HC Standards

What Commenters Said:

EMD commented that the alternative Tier 4 NOx+HC standard should be equal to the sum of the NOx and HC standards, not the NOx standard only.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1

Our Response:

We agree that the alternative Tier 4 NOx+HC standard should be equal to the sum of the NOx and HC standards, but believe the sum must be rounded down to prevent gaming. Thus for locomotives, the alternate standard will be 1.4 g/bhp-hr. For marine it will be 1.9 g/kW-hr.

4.3.7 Changing Locomotive FELs

What Commenters Said:

EMD questioned the requirement that manufacturers and remanufacturers must notify locomotive purchasers that locomotives certified to an FEL different from the applicable standard must comply with that FEL throughout their service lives. The commenter noted that the FELs to which the locomotive is certified are included on the locomotive label, and that EPA requires labels to include the statement, “THIS LOCOMOTIVE MUST COMPLY WITH THESE EMISSION LEVELS EACH TIME THAT IT IS REMANUFACTURED, EXCEPT AS ALLOWED BY 40 CFR 1033.750.” The commenter stated that it believes the current label statement is sufficient notification, as the locomotive emissions label is required to stay on the locomotive throughout its service life.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1

Our Response:

We continue to believe that it is essential that all parties involved in such remanufacturing be fully aware of the requirements associated with changing an FEL for a locomotive. The small burden associated with the required notification is clearly justified by this important policy goal. EMD provided no basis for us to conclude otherwise.

4.3.8 Incentives for Replacing or Refurbishing Old Switch Locomotives

What Commenters Said:

AAR commented that it supports the concept of providing credits for replacing old switch engines with low-emitting switch engines, as it believes that government incentives to place low-emitting switchers in service are in the public interest. The commenter noted that the proposed provision was in the preamble, but not the regulations; the commenter urged that EPA include this provision in the final rule regulations. The commenter noted that most of the switch locomotives in the Class I railroads' locomotive fleets are among the oldest locomotives operated by Class I railroads and are generally used for many decades. The commenter further noted that turnover of these locomotives is very slow. The commenter also stated that, even though industry has developed the gen-set and hybrid switchers, the small number of these locomotives that have been placed in service often have been purchased with government assistance. Lastly, the commenter noted that it believes that EPA is rightly concerned that without government incentives, innovative switch engines will remain a small portion of the switch locomotive fleet.

Railpower Hybrid Technologies commented that it believes EPA can also help to expedite the introduction of these ultra-clean locomotives by creating even more incentive for the railroads to do so prior to the proposed implementation dates. The commenter suggested that EPA allow railroads to take full advantage of banking ABT credits when purchasing a unit that is remanufactured in a manner such as theirs. The commenter stated that it believes that changing the ABT factor so to not discount the amount of earned credits when purchasing a remanufactured ultra-clean locomotive will help this occur. Railpower further commented that it believes that if the railroads are given additional incentive to purchase an ultra-clean technology over the alternative of continuing to rebuild and use older, dirtier locomotives and it still make good overall business sense for their company, then they can justify more and earlier introduction of the ultra-clean technologies like theirs.

California Air Resources Board (CARB) commented that it believes there will be a growing trend to provide financial incentives from federal and state agencies (e.g., California's Carl Moyer Program and Texas' Emission Reduction Program) to replace older (40 years on average in California) switch locomotives with advanced technology switch locomotives that can provide up to 90 percent reduction in both NOx and PM, a 20 to 40 percent savings in diesel fuel consumption, and reductions in greenhouse gases (GHGs). The commenter further stated that the existing Tier 2 or 3 nonroad engines in the gen-set switch locomotives can be upgraded with future cleaner Tier 4 nonroad engines upon remanufacture. The commenter noted that the gen-set switch locomotive has ample space and is more easily adaptable than traditional diesel-electric locomotive engines for retrofitting of aftertreatment devices such as diesel oxidation catalysts (DOC), DPFs, and SCR.

The South Coast Air Quality Management District (SCAQMD) commented that the use of multiple off-road engines in conjunction with DPFs and SCR to achieve or exceed the proposed Tier 4 emission standards is particularly promising because it relies on existing, commercially available engines, and because such multiple engine configurations have been successfully utilized to create lower emission switch locomotives. The commenter stated that it believes that there is no technical reason why such engines and configuration should not be able to achieve a Tier 4 line-haul locomotive in a timeframe enormously accelerated from EPA's proposed regulation. (The commenter noted that a copy of the presentation from National Rail Equipment Company and Cummins attached to its public comments.) SCAQMD also commented that, as part of California's Carl Moyer Incentives Funding Program, it has received a proposal to retrofit a Tier 0 line-haul locomotive from mechanical injection to electronic injection technology; and further that, if this is proven feasible, there will be a low cost approach to further clean up existing Tier 0 and Tier 1 locomotives.

Letters:

Association of American Railroads (AAR)	OAR-2003-0190-0566.1
California Air Resources Board (ARB)	OAR-2003-0190-0596.1
Railpower Hybrid Technologies Corp.	OAR-2003-0190-0492 (hearing)
South Coast Air Quality Management District	OAR-2003-0190-0558.1

Our Response:

We agree with the general goal of creating incentives for railroads to scrap or refurbish old switch locomotives. However, we are not creating specific incentives. Rather, we have structured our ABT program and our requirements for refurbished locomotives in such a way as to also create an incentive to eliminate old high-emitting locomotives from the fleet. We agree with the general belief of CARB and SCAQMD that with appropriate incentives, it may be possible for many Tier 2 gen-set switchers to be retrofitted with Tier 4 engines or for some freshly manufactured switch locomotives to meet the Tier 4 standards slightly earlier than required, and have structured the program to allow such retrofits and early introductions. However, as noted in Chapter 10, we believe that the standards and schedule being finalized are the most stringent that can be mandated considering cost and other relevant factors.

4.3.9 Incentives for Replacing Old Marine Engines

What Commenters Said:

Kirby Corporation requested that EPA consider additional measures to provide incentives or tax credits to encourage vessel owners to replace older engines with cleaner-burning replacements. The commenter stated that it believes such a program would have great value in encouraging the replacement of older engines and encouraging faster stride toward emissions reductions. The commenter also noted the California and Texas programs that have significantly aided in accelerating emission reduction technologies in the marine vessels through the Carl Moyer Program and the Texas Emission Reduction Program. The commenter stated that it believes that programs such as these, or tax credits for capital expenditures on environmental reduction technologies, will greatly aid in achieving a balanced approach for realizing economically feasible emission reductions.

Letters:
Kirby Corporation OAR-2003-0190-0563.1

Our Response:

We agree that replacing old marine engine with new cleaner engines is a valid environmental goal. However, it is not clear how we could do so in the current regulatory construct. Nevertheless, we may reconsider such incentives in another context.

4.3.10 Definitions for Averaging

What Commenters Said:

EMD noted that in both the locomotive and marine parts, there is a sentence in the general definition of "applicable emission standard" saying that the definition "does not apply to [the averaging, banking, and trading subpart] of this part." The commenter stated that it does not understand this, since both ABT subparts use the phrase "applicable emission standard" (§1042.705(a), §1033.705(b)). The commenter stated that it believes that the definition given seems applicable to both of those subparts, and suggested that EPA delete the cited sentence in the definition.

EMD noted that "Actual Emissions Credits" are defined as credits that EPA has verified by reviewing a manufacturer's final ABT report. The commenter questioned whether EPA has a mechanism for carrying out such a review. The commenter noted that it has been submitting ABT reports since calendar year 2002, and has never been notified that its claimed credits have been accepted by EPA. The commenter further stated that, upon asking the EPA certification contact whether EPA intended to respond, EMD was told not to expect a response, but to use the accrued credits as if they were banked. The commenter questioned how a manufacturer is supposed know when credits become "actual."

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1

Our Response:

In all subparts other than the ABT subparts the term "applicable emission standard" means either the specified standard if the family does not participate in the ABT program or the FEL if it does. However, in the ABT subpart the term "applicable emission standard" means only the standard. We have revised the regulations to make this clearer.

The distinction between "actual" and "reserved" credits does not normally have a practical significance. However, these two modifiers are used in a strict regulatory sense to emphasize that all credits remain subject to EPA approval until they are reviewed. Manufacturers who choose to rely on reserved credits may not prevent EPA from reviewing the credits at a later time.

4.3.11 Accounting for Special Locomotive Technologies

What Commenters Said:

GE noted that regardless of the emissions limit EPA promulgates for Tier 4 NOx, it is essential that the certification process allow manufacturers to determine the certified emissions level impact of any technology that reduces emissions. The commenter urged EPA to adopt regulatory provisions that allow for the above technologies to be implemented as well as future technologies. From a process perspective, the approval of these types of technologies in an application would be similar to the approval for AESS systems. The commenter noted that if a manufacturer elects to utilize these provisions and a railroad elects to purchase these features, the information showing the emissions reductions would be included in certification application; and then EPA would review and approve the analysis and testing conducted by the manufacturer as it does with all applications. The commenter suggested language that could be used to implement its recommendation, and urged EPA to include that language (or some similar) in the final rule. The commenter also provided additional detail about such technologies.

AAR noted railroads have every incentive to implement consist management systems that will save fuel and emissions. However, the commenter noted, railroads oppose a mandate to adopt such systems. The commenter stated that it believes that it would be difficult, if not impossible, to quantify the emissions reductions from such systems with the precision required for the purposes of a regulation; further such reporting would be burdensome for the railroads, monitoring compliance would be difficult for EPA, and the railroads could not afford to stop locomotives from operating when such systems failed to function properly. AAR commented that, despite the railroads' concerns over the practicality of quantifying emissions reductions from consist management systems, the railroads do not oppose giving industry the option of demonstrating that EPA emissions standards could be met, in part, by such systems or by any other technology. The commenter stated that it supports including in the regulations a procedure whereby a certifier can demonstrate the emissions reductions from such systems with the precision required for certification and thereby receive the appropriate credit for the demonstrated reductions.

EMD commented that because the emissions reductions possible by consist management are small relative to the total reductions projected by adoption of the new locomotive standards, EPA should not mandate consist management devices that would seek to optimize emissions by operating locomotives at their optimum emissions points. The commenter stated that it believes that EPA should instead include a provision in the final rule that would allow a manufacturer to request approval from EPA for reduction in the emissions values reported on a certification application for locomotives that incorporate such a device, similar to the current provision that allows manufacturers to claim an emissions reduction for locomotives with idle reduction devices. (EMD noted that in this instance, it supports the inclusion of an approval provision, because the nature and performance of consist management devices are likely to vary considerably.) The commenter also suggested that EPA should leave the fuel consumption reduction possibilities of consist management devices to be driven by the market

Lat-Lon LLC provided comments on its locomotive monitoring system which utilizes wireless communications (GSM/GPRS) and GPS location and speed sensing. The commenter stated that with the installation of this aftermarket system, engine idle times can be determined from primary data including engine run state (run/stop) and speed.

CARB commented that further research and investigation be done to account for technologies such as GE Smartburn (engine adjustments to lower NOx or PM tradeoffs within specific geographical regions), and use of Distributed Power Units (DPUs), Consist Management, and Trip Optimizers can provide emission reductions for specific locomotive operations.

Letters:
Association of American Railroads (AAR) OAR-2003-0190-0479, 0510, 0566.1
California Air Resources Board (ARB) AR-2003-0190-0596.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502, 0594.1, 0662
General Electric Transportation (GE) OAR-2003-0190-0590.1
Lat-Lon LLC OAR-2003-0190-0481

Our Response:

We agree the regulations need to include provisions to address new technologies that reduce emissions by reducing the amount of work done by the engine (or the amount of fuel consumed) rather than by reducing the brake-specific emissions. These provisions can be found in §1033.530 (g) and (h) of the final regulations.

4.4 Switcher Issues

4.4.1 Switcher Definition and Test Cycle

What Commenters Said:

EMA agreed with the NPRM's proposal to clarify the definition of a switcher locomotive based on total engine power of less than 2300 hp and added that the total locomotive power should include all engines on the locomotive, including those that drive locomotive accessories and may not be directly linked to the traction drive. They commented that this should apply to both the power for switcher definition and the cycle emissions calculations. The current provision of allowing the head-end power unit to be a nonroad certified engine without inclusion in the locomotive cycle emissions should be retained.

Letters:
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

We agree that hotel engines should be included in the power for determining whether a locomotive is a switcher. Specifically, we are revising the regulations to include auxiliary engines in the calculation of total power, but only if the engines are permanently installed on the locomotive and can be operated while the main propulsion engine is operating. This means that the power of auxiliary engines that operate only to reduce idling time of the propulsion engine would not be counted.

4.4.2 Use of Certified Nonroad Engines

What Commenters Said:

MTU Detroit Diesel, Inc. (MTU) commented that it is in full support of the proposed provision in §1033.150 to use certified nonroad engines in switcher locomotive applications through model year 2017 to aid in the introduction of clean switcher locomotives; however, the commenter requested that EPA provide clarification regarding this ‘streamlined path.’ MTU noted that EPA included the proposed provision that engines greater than 750 hp be excluded from this optional certification beginning in 2014 unless the engine is certified to the generator set standards; the commenter suggested that, instead of excluded engines from this power category, EPA should allow nonroad certified engines that are certified to emission levels at least as stringent as the proposed locomotive standards for the same year. The commenter noted that the limitation of ”15 in a three-year period” differs from the ”30 in a three-year period” that is included in Part 92. MTU commented that it supports the limitation on the number of nonroad engines that may be allowed to be introduced as switcher locomotive engines, after the 10-year streamlined path, but suggested that the limitation should be modified to 30 engines built and introduced over a three-year period.

EMA noted that proposed §1033.150 set forth a provision exempting switcher locomotives from certification, PLT, and in-use testing requirements if a certified nonroad engines is used, but §1033.625 states that up to 15 locomotives are allowed to be produced and sold over a 3-year period with certified nonroad engines. The commenter stated that it believes that these two sections appear to be contradictory to one another. The commenter suggested that EPA clarify in the final rule that §1033.150 allows an unlimited number of certified nonroad engines to be utilized in switcher locomotives as a part of a ‘streamlined path’ (as discussed in the preamble at 72 FR 15983), for a ten-year window to facilitate and accelerate the introduction of clean switcher locomotives. The commenter agreed that the proposal to allow clean emission technology engines that are nonroad certified into locomotive applications utilizing a ‘certification by design’ technique will allow a streamlined path to improve emissions, but requested that EPA clarify the term “certification by design” by adding the definition of this term to §1033.901 in the final rule. EMA also commented that it does not agree with the approach of restricting the use of certified nonroad engines in locomotives (§1033.625) to no more than 15 locomotives over a three-year period. The commenter suggested that this restriction be removed from the regulations, as it is contradictory to the Technical Amendment package of September 2005 that allowed 30 locomotives to be built and delivered with nonroad engines in a three year period.

EMA noted that proposed §1033.150 sets forth three distinct prerequisites in order to allow certified nonroad engines into switcher applications ((i) the engines must be current certified nonroad engines, (ii) less than half of the engine manufacturer's total production volume of the nonroad engines must be going into switch locomotives; and (iii) the engine manufacturer may not generate locomotive emission credits through the 'streamlined path' provision), the commenter stated that it believes that some of these limits/requirements will adversely affect the incentive to implement the 'streamlined path.' The commenter noted that state incentive programs (like Carl Moyer) drive a demand for emission levels lower than the applicable locomotive emission standards. The commenter stated there is thus an emission standards gap between certified nonroad engines and locomotive engines of the same Tier. The commenter stated that it believes that the proposed limit on the generation of emission credits from the use of certified nonroad engines in switch locomotives will, in effect, result in a penalty on the manufacturers of these cleaner engines/locomotives, and may cause a disincentive to utilize the cleaner technology engines.

EMA commented that it is not convinced that the marketplace will be interested in using 'exempt' or 'streamlined' nonroad engines without the benefits of ABT utilization, and EMA recommended that the same FEL or LEV certification be allowed for any certified nonroad product that is used in a 'certified by design' switcher locomotive under §1033.150. The commenter similarly stated that it believes that, as there are no Tier 3 nonroad emission standards for engines above 560 kW and the nonroad Tier 2 standards are lower than the proposed Tier 3 switcher locomotive standards (with the exception of PM), the use of a nonroad Tier 2 certified engine should be allowed for use in a Tier 3 switcher locomotive. The commenter noted that, because of the difference between nonroad and locomotive applications in the timeline for the implementation of each Tier of standards, it will be difficult to implement the 'streamlined path' mentioned in the NPRM. The commenter noted that it was proposed that the locomotive Tier 2 levels would apply between 2005 and 2010 for switcher applications. The commenter stated that, although it is expected that there will be a difference in NOx levels when tested over the nonroad test cycle as compared with the locomotive test cycle, the magnitude of the difference in the standards for NOx between the nonroad (4.77 g/hp-hr (6.4 g/kW-hr)) and locomotive (5.6 g/hp-hr (7.5 g/kW-hr)) engines makes it clear that the utilization of the streamlined path would be advantageous to the environment. However, the commenter stated, manufacturers may not have currently certified nonroad Tier 2 engines to make available to the locomotive marketplace because of the difference in the implementation timelines—the Tier 2 nonroad dates have already passed in some cases.

EMA commented that it believes that it is essential to the rebuild and upgrade of switcher locomotives that legacy nonroad engine products be made available after the next nonroad Tier level standards go into affect, such that railroads may continue to use Tier 1 and Tier 2 nonroad engines in Tier 1 and Tier 2 switcher locomotives. The commenter further stated that it believes that this brings into focus the need for a provision to allow engine manufacturers to build and sell previously certified nonroad products into the switcher market, and would be difficult to manage with a limit of less than 50% of the production volume going into switcher locomotive applications. The commenter noted that without legacy nonroad engines, small businesses would have to upgrade their legacy switch locomotives to Tier 3 levels if no previously certified nonroad Tier 2 engine were available on the market; and the cost of upgrading to a Tier 3 locomotive may be prohibitive, especially if there are no Tier 3 'kits' available in the market. The commenter stated that it believes this provision should be included in the rule least as a contingency for small railroads. The commenter also noted that the service life of a switcher locomotive can be as long as 40 years (as described by the proration factors in §1033.705 (d)), and thus suggested that the window of availability for the streamlined path extend beyond 10 years for replacement engines that are installed in switchers that were initially certified under the streamlined path.

Cummins Inc commented that it believes EPA should adopt the proposed provisions allowing the expanded use of nonroad certified engines in switcher locomotive applications. The commenter noted that nonroad emission limits are generally more stringent than the locomotive limits, and believes that the proposal provides the needed flexibility to use nonroad certified product while eliminating the financial burden of certifying identical engines to multiple standards.

<u>Letters:</u>
Cummins Inc. OAR-2003-0190-0559.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1
MTU Detroit Diesel, Inc. OAR-2003-0190-0573.1

Our Response:

It is important to emphasize that the long-term goal of the regulations is for switch locomotives produced using other nonroad engines to fully comply with all applicable requirements of Part 1033. As is discussed below, we are including an option for certification by design plus a more flexible interim program.

As part of the long term program, we will allow manufacturers to certify by design up to 30 locomotives within a three-year period (instead of the proposed limit of 15). We are adding a definition of "design certify" to §1033.901 of the regulations. That definition clarifies that allowing a manufacturer to design certify only eliminate the need to collect new test data for the locomotive before certification. We believe that it is a legitimate concern that requiring a nonroad engine manufacturer to build and test a prototype locomotive before it can apply for a certificate could delay the introduction of new clean switch locomotives. We further believe that this delay is probably unwarranted where the engine has already been certified under Part 89 or Part 1039 to numerically lower standards. However, we are limiting this to 30 locomotives because once the manufacturer has begun producing these locomotives, it will be able to collect the required data, especially once it begins performing the required production-line testing.

With respect to the interim program, we are adding a clarification that it allows an unlimited number of switch locomotives to be produced. We have revised the regulations to be clear that such engines are not required to meet the Part 1033 requirements when remanufactured. However, because this regulatory change excludes such remanufactured engines from the definition of new, the special preemption provisions for new locomotives would also not apply for them. While EMA may be correct that prohibiting these engines from generating credits under Part 1033 may be a disincentive to use this option, manufacturers are free to use the locomotive-specific certification option.

EMA's comment that sections 1033.150 and 1033.625 are in conflict appears to be a failure to recognize that they are two independent programs. The comments by EMA and MTU about Tier 3 and Tier 4 engines also appear to result from a misreading of the proposed regulatory text in §1033.150. The only engines for which this option is not available are engines over 750 hp certified to the Tier 4 standards for non-generator set engines after 2014.

4.4.3 Altitude Requirements for Locomotives

What Commenters Said:

EMA noted that proposed §1033.115(e) is a carry forward from 40 CFR 94, requiring engine manufacturers to ensure that engines will comply with emissions standards up to 7,000 feet above sea level; however, the commenter noted, as stated in the preamble the "certifying switch locomotive manufacturer is typically a purchaser of non-road engines and not involved in their design" (72 FR 15972). EMA noted that, beginning with Tier 4, all nonroad engines will be certified for emissions compliance up to 5,500 feet altitude (§1039.101(e)(4)(I)). The commenter noted that there will be few (if any) switcher engines operating above 5,500 feet altitude. The commenter stated that it therefore believes that requiring engine manufacturers to ensure that their nonroad based locomotive switcher engines will meet emissions standards up to 7,000 feet is an unreasonable burden without any reasonable emissions benefits, and requested that §1033.115(g) be changed to reference 5,500 feet maximum altitude above sea level for new switcher engine applications.

Letters:
Engine Manufacturers Association (EMA)   OAR-2003-0190-0575.1

Our Response:

We agree that switchers are much less likely to operate between 5,500 and 7,000 feet, and are modifying the regulations to not require switchers to necessarily meet the standards at these altitudes.

4.5 SCR Issues

4.5.1 Urea Monitoring

What Commenters Said:

AAR commented that it does not understand how urea quality would be monitored, regarding the requirement that diagnostic systems for urea-SCR systems monitor urea quality (§§1033.110 and 1033.112). In addition, the commenter suggested that §1033.112 be amended by: deleting "urea quality" in the first sentence and by deleting the second sentence of §1033.112(a); by deleting "or urea quality" from §1033.112(b); and that EPA reconsider its requirements for malfunction indicator lights.

GE commented that while monitoring of urea levels may make sense, it believes the proposal to monitor urea quality is both vague and unnecessary and presumes that urea is the only reductant fluid that might be used. The commenter stated that it agrees that monitoring urea levels is workable; however, the commenter suggested that EPA should not adopt a requirement for monitoring urea quality in the final rule. The commenter stated that the proposal vaguely referred to 'urea quality' without specifying what constitutes acceptable or unacceptable quality, and it does not believe that the rule should mandate quality monitors without an adequate understanding of what can and should be monitored and how that might affect emissions performance. The commenter further noted that EPA projected that a large urea infrastructure will be developed to support the already-promulgated requirements for aftertreatment on trucks; as such, the commenter stated, EPA should impose any requirements regarding urea quality on the fueling infrastructure rather than creating "a vague monitoring provision for the locomotive manufacturers." The commenter also noted that it is possible that over the proposed development timeline for aftertreatment systems that a suitable alternative to urea could be adopted as the reductant fluid in aftertreatment systems. GE also commented that it is not aware of a urea quality sensor that could withstand the locomotive environment and detect the concentration of the urea on a real-time basis. The commenter also stated that it does not believe that EPA's alternative of allowing use of NOx sensors instead of urea quality monitors is workable.

Regarding the request for comment on minimizing the complexity and cost of a diagnostic system and precluding tampering (72 FR 15993), EMA commented that it believes EPA's proposal amounts to in-use compliance requirements on engine manufacturers and is extremely problematic. The commenter noted that the marine industry is highly non-integrated, and engine manufacturers typically are not involved in the design or manufacture of vessel console systems (including malfunction indicator lights (MILs)) or alarms. The commenter also noted that engine manufacturers know of no established methods for detecting 'adequate' urea 'quality' on a real-time basis in-use—the commenter thus believes that the durability of NOx sensors is a key unresolved issue (and the commenter questioned whether an unanticipated NOx reading would be related solely to urea quality in any event). EMA recommended that EPA work with vessel manufacturers - not engine manufacturers - to develop reasonable means to help assure that vessel operators consistently use urea of acceptable quality in those vessels equipped with SCR systems. The commenter also stated that the in-use regulation of urea utilization in marine vessels is a fundamentally different issue than it is with respect to heavy-duty on-highway (HDOH) vehicles; given the priority that must be placed on the safe and reliable operations of vessels at sea, the commenter stated that it believes that many of the proposed options for ensuring urea usage in on-highway vehicles are out of the question in the marine environment. The commenter also stated that it believes that the U.S. Coast Guard and other classification societies would prohibit the use of any of the proposed HDOH strategies for ensuring urea use in vessels. EMA suggested that EPA consult with marine architects, vessel builders, and the U.S. Coast Guard before finalizing any requirements relating to the assurance of urea use and quality. EMA commented that it has concerns with the proposed diagnostic requirements (§1042.110(a)) on urea use and quality. The commenter stated that any SCR-related diagnostics must be limited to the measurement capabilities of available sensors, and it believes that the requirements of §1042.110(a) will need to be revisited by EPA if such sensors are not developed adequately for the higher-volume on-highway and nonroad applications. The commenter also stated that engine manufacturers object to the requirements of §§1042.110(b) and 1042.115(c) that would provide EPA access to proprietary engine information—the commenter suggested that these paragraphs be deleted.

Letters:

Association of American Railroads (AAR)	OAR-2003-0190-0566.1
Engine Manufacturers Association (EMA)	OAR-2003-0190-0575.1
General Electric Transportation (GE)	OAR-2003-0190-0590.1

Our Response:

The comments summarized here seem to agree in general with our intent regarding the requirement to monitor reductant (urea) level and quality while raising narrower concerns regarding our expectations for how these regulations would work. These regulations are not intended to narrowly prescribe a requirement to precisely measure the quality of urea but rather to require the manufacturer provide a system that would inform the end-user if poor quality urea is inadvertently or purposefully added. Since 2005, Mitsui Corporation has been selling a combination urea level and quality sensor in the Japanese market that can serve this function. In early 2006, Mitsui announced it had created a partnership to distribute its sensor technology to the U.S. market. We are confident in projecting that this direct method of measuring urea quality can be further developed and applied to locomotive and marine applications well before it would be required in 2014 (or later).

In addition to a direct measure of urea quality, our regulations also make clear that we will accept an indirect measure of urea quality based on NOx emission monitoring and rationality logic used to check urea quality. In simplistic terms, if the urea dosing versus NOx control characteristics change immediately after an increase in urea level is observed by a level sensor, it would be reasonable to infer that the added urea was of different quality. If the NOx control characteristics were so poor as to lead to inadequate NOx control (exceeding the NOx standard), the rationality logic would conclude the urea was of inadequate quality. If performance with the NOx standard were maintained, the rationality logic would conclude the urea was different but of acceptable quality. It is therefore up to the engine manufacturer to determine what it considers to be adequate urea quality with regard to this aspect.

As we have described in our recent nonroad Tier 4 regulations, our recent heavy-duty (HD) onboard diagnostic proposal and in our Final RIA for this rulemaking, we continue to expect that NOx sensor already in production for light-duty passenger vehicles will continue to improve with respect to durability and accuracy such that they will be an appropriate technology solution for U.S. HD trucks in 2010 much less locomotive and marine diesel engines in 2014 and later.

4.5.2 Ammonia

GE requested that EPA clarify the preamble and regulatory statements regarding noxious emissions to clarify that ammonia emissions, a product of the required aftertreatment systems, are not considered noxious. The commenter noted that the NPRM indicated that that the controls that manufacturers use to comply cannot cause noxious emissions (72 FR 15998 and §1033.115(c)). The commenter noted that ammonia causes a pungent odor at a concentration of approximately 5 ppm and eye irritation at 20 ppm. The commenter also noted that for locomotives using aftertreatment, given the size of the engine, it is expected for both transient and steady-state emissions of ammonia to exceed the 5 ppm threshold at which ammonia creates a “pungent” odor. GE further stated that its calculations show that the steady-state ammonia slip with fresh catalyst is 10 ppm and with a deteriorated catalyst can be upwards of 18 ppm, approaching the 20 ppm level at which eye irritation is reported. The higher ammonia concentrations from a locomotive are due to the size of the engine, and due to the level of inlet NOx, there will be a greater amount of urea with corresponding ammonia slip increases. The commenter further noted that the catalyst used to minimize ammonia slip operates by adsorbing the ammonia and storing it; however, when the catalyst reaches a certain temperature, it will release the ammonia it has adsorbed. When the release occurs, it is expected that there will be insufficient NOx present to react with the ammonia to completely convert it to nitrogen, and as a result, the ammonia that is not converted will be released; GE commented that it expects to see transient ammonia concentrations on the order of 50 ppm.

GE stated that it is the company’s understanding that EPA: (1) has evaluated these potential impacts[2]; (2) recognizes there will be concentrations that create an odor recognizable to the public; and (3) has concluded that they are acceptable in light of the benefits EPA believes are derived from the Tier 4 NOx standard. The commenter requested that EPA clarify that this issue has been reviewed and that EPA has concluded this level of ammonia emissions, even though causing an odor, would not be considered to “cause or contribute to an unreasonable risk to public health, welfare, or safety while operating” within the meaning of §1033.115.

2 GE footnote 15: EPA staff members have indicated that ammonia cannot be detected up to 17 ppm and have cited that there is a range of potential concentrations under which it can be detected. GE requests that EPA explain in the final rule how its evaluation compares with the 5 ppm threshold established by ATSDR [Agency for Toxic Substances and Disease Registry (Department of Health and Human Services)] as GE has not found literature suggesting that concentrations between 5 ppm and 17 ppm do not cause a pungent odor.

Electro-Motive Diesel, Inc. (EMD) also commented that EPA needs to recognize that emissions of ammonia from NOx aftertreatment systems will be inevitable in engines using selective catalytic reduction to meet the proposed locomotive and marine Tier 4 standards, particularly during transients. Ammonia is a noxious gas toxic in high concentrations, detectable by the human olfactory system at concentrations between five and fifty parts per million. EPA should structure these paragraphs not to disallow emissions of ammonia at technically feasible levels; if EPA fails to do so, manufacturers may be left with no way to meet the Tier 4 standards.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
General Electric Transportation (GE) OAR-2003-0190-0590.1

Our Response:

The issue of NH_3 emissions (or ammonia slip) was raised by several commenters, with claims that excessive NH_3 emissions are "inevitable", and may reach 25 ppm during steady-state operation and 100 ppm during transient operation. We have assessed this issue and concluded that a properly-designed slip catalyst, with good selectivity to nitrogen (N_2), can convert most of the excess NH_3 released from the SCR catalyst into N_2 and water. Recent studies by the Johnson Matthey and the Association for Emissions Control by Catalyst (AECC) have shown that an aged SCR system equipped with a slip catalyst can achieve tailpipe NH_3 levels of less of than 10 ppm when tested on the European Stationary Cycle (ESC) and European Transient Cycle (ETC). The SCR system in the Johnson Matthey study was aged on a cycle which included 400 hours of high-temperature operation at 650 °C (to simulate active DPF regeneration events). Our analysis of the locomotive engine operating conditions presumes a maximum, post-turbine exhaust temperature of 560 °C. This presumption is based on implementation of a "passive" DPF regeneration approach (in which NO_2 created by the oxidation catalyst is sufficient to oxidize trapped soot) and our own testing of locomotives during consist operation in non-ventilated tunnels. Under these conditions, we expect slip catalysts to be durable and effective in reducing NH_3 slip.

Compact urea-SCR systems that have been developed to meet the U.S. 2010 heavy-duty truck standards use closed-loop controls that continuously monitor NO_x reduction performance. Such systems have the capability to control stack emissions of NH_3 to below 5 ppm during transient operation even without the use of an ammonia slip catalyst. We understand that such systems may still emit some very small level of uncontrolled pollutants and we would not generally consider a system that releases de minimis amounts of NH_3 or nitrous oxide (N_2O) while employing technology consistent with limiting these emissions to be in violation of §1033.115 (c) – which is the same way we currently treat passenger cars and heavy-duty trucks with regard to N_2O and H_2S emissions.

It also should be clear that the levels of slip which we believe could be experienced (<25ppm) in the exhaust stack would be rapidly diluted by ambient air at a ratio well in excess of 1,000:1 leading to ammonia levels near a Tier 4 locomotive well below levels detectable through smell.

4.5.3 AECDs

Regarding AECD allowances for urea SCR systems, EMA noted that the NPRM does provide some instructions regarding defeat devices and allowable AECDs. Those provisions are similar to what is found in EPA's on-highway and nonroad rules for diesel engines. In addition to the AECD allowances found in other rules, the NPRM proposes additional language regarding AECDs for urea SCR systems.

EMA commented that it fully supports the addition of regulatory language regarding AECDs for urea SCR systems, but believes that there are several changes necessary to EPA's proposed language. EMA recommended revisions to §1042.115(f) (Docket Number OAR-2003-0190-0575.1, pp. 78-80 of the comment letter) to better reflect the manner which AECDs may need to be utilized and to create better alignment with the proposed Global Technical Regulation. Specifically, EMA commented that it revised (f)(4)(i)(A)-(B) as it believes that these regulatory paragraphs were too restrictive. The commenter noted that subparagraph (A) limits an AECD to operations outside of the duty-cycle test range of ambient temperature and atmospheric pressure, but commented that this is restrictive as it may be necessary to use an AECD that reduces or stops urea flow while inside those ranges (such as on a light duty-cycle when exhaust temperatures are too low for urea dosing). The commenter stated that it ambient conditions are not always a good indicator of exhaust temperatures. EMA noted that subparagraph (B) limits an AECD to operations at speed/load conditions that are not part of the duty-cycle test, but commented that this is also restrictive as it may be necessary, for example, to use an AECD that reduces or stops urea flow even at speed/load conditions, such as idle, that are considered duty-cycle test points.

EMA also proposed new language for subparagraph (f)(4) that corresponds with the defeat device language found in the proposed Off-cycle Emission Global Technical Regulation. The commenter stated that it believes that this proposed language would allow EPA broader authority to approve, and manufacturers to use, a variety of possible AECDs when necessary to compromise control of one emission to gain an acceptable level of control of another emission; and could also be a reference for the allowance of specific AECDs relating to urea SCR systems. The commenter also recommended that EPA include separate language specific to those systems, similar to what EPA provided in the NPRM, and the commenter proposed a new subparagraph (f)(5) (OAR-2003-0190-0575.1, p.79). The commenter stated that it believes this new language will: 1) allow for the general approval of AECDs in a manner similar to EPA's initial proposal found in subparagraph (f)(4)(ii)(A); 2) allow an AECD where exhaust temperatures are too low to convert urea to ammonia. The language here also is consistent with the NPRM; 3) allow an AECD during the time of urea thawing; and 4) allow an AECD during the time that the SCR exhaust inlet temperature is above the crystallization point of the urea in the injection system, or in the catalyst system itself.

EMA also proposed that its suggested edits to §1042.115(f) be incorporated into the current on-highway and nonroad regulations as well.

Letters:
Engine Manufacturers Association (EMA)   OAR-2003-0190-0575.1

Our Response:

We have met with the commenter on a number of occasions to discuss its comments including its comments with respect to our AECD provisions and the use of urea SCR catalyst technology. Through that process, the commenter has made it clear its first priority is that the Agency have a consistent policy with regard to AECD provisions and urea SCR catalyst technology. More simply put, the commenter would like to have confidence that solutions its member companies develop in order to comply with our on-highway and nonroad regulations would be equally acceptable under these marine regulations. We agree with this sentiment and believe the best way to ensure we can accomplish that goal is to not finalize the proposed AECD revisions, and instead, allow the marine urea SCR compliance path to follow the on-highway and nonroad guidance where appropriate. We believe our current AECD regulations give us broad authority to grant AECDs for elements of system design necessary to limit ammonia emissions or any other characteristics of the system which could have the potential to create an unsafe condition. We fully intended to continue to work with the commenter and its member companies as they develop urea SCR systems to comply with a wide range of our diesel NOx regulations.

4.5.4 Urea Use

What Commenters Said:

The New York State Department of Environmental Conservation noted that engines equipped with SCR technology require a reductant (urea) to work as designed. The commenter stated that since the projected Tier 4 NOx emissions reductions depend on the owner/operator maintaining a supply of the proper reductant necessary for the operation of SCR, an enforceable mechanism is required to ensure that the SCR reductant is in fact supplied. The commenter stated that it believes that the proposed requirements for SCR (low reductant level warnings, tracking/logging of incidents of engine operation without urea, and incident notification requirements) are steps in the right direction, but the commenter urged EPA to take additional steps to ensure SCR operation compliance and enforcement. The commenter suggested the following as part of a periodic emissions I&M program: reviews of SCR reductant usage records, reviews of the computer SCR operating log, and documentation/reporting of incidents of improper SCR operation.

Letters:
New York State Department of Environmental Conservation, Office of Air Resources
OAR-2003-0190-0583.1

Our Response:

The regulations already prohibit operation without urea (or other needed reductants), require automatic data logging, and require operator recordkeeping. Since we may inspect the locomotive or ask for these records at any time, we do not see a need to also include a special I&M program.

4.5.5 Non-Urea Reductants

What Commenters Said:

EMD commented that the proposed regulations contain multiple uses of the words "urea" and "ammonia." The commenter is concerned that these words are used based on an assumption that the Tier 4 NOx standards will be met by urea SCR; however, the commenter stated that much work is being done in the diesel exhaust aftertreatment area, and it is possible that by the time the Tier 4 standards take effect, urea will not be the reductant of choice. The commenter recommended that EPA use more generic language, such as "any necessary reductant" instead of "urea," or "urea or other reductant" (as has already been done in §1042.660).

<u>Letters:</u>
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502, 0594.1

Our Response:

We agree and have revised our regulations to state "reductant" unless the provision is specific to urea.

4.6 Railroad Requirements

What Commenters Said:

EMD commented that it believes that EPA should make clear, with simple declarative sentences, what the expectations are upon remanufacture of a conforming locomotive; specifically, whether it is sufficient simply to rebuild the locomotive in kind, or if it is necessary to apply a new remanufacture system. The commenter stated that the current provisions that express the requirement that a conforming locomotive engine be recertified with the application of a new remanufacture system and a new engine label when it is remanufactured are scattered throughout the rule. The commenter further noted that there is considerable misunderstanding of the requirement in the industry because of this. The commenter stated that it believes that the provision in the proposed new locomotive rule is an improvement in this respect, but still does not make the requirements sufficiently plain. EMD requested that, since Part 92 will continue to be in effect for some locomotives for some years to come, EPA clarify the remanufacturing requirements for owners and operators.

In its comments, AAR suggested that the in-use testing program for railroads be modified (§1033.810). The commenter noted that, in practice, the in-use testing program has diverted from this original intent because no locomotives have reached the end of their useful lives (many engines are remanufactured prior to the end of their useful life period) and because EPA has sought data from newer locomotives to help in the development of the NPRM. AAR suggested that rather than using whether the locomotives have been operated for their full useful lives or near the end of their useful lives as the sole criterion for testing, the flexibility of the current program could be preserved by permitting the use of other criteria to select locomotives for in-use testing. The commenter stated that it believes this flexibility would permit the railroads and EPA to select a mix of locomotives to be tested that meets EPA's needs. AAR also suggested that EPA cut the number of locomotives to be tested under the in-use testing program in half.

Letters:
Association of American Railroads (AAR) OAR-2003-0190-0566.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502 (hearing), 0594.1

Our Response:

We agree in general with both of these comments. We have modified §1033.805 and are adding a similar section to Part 92 (§92.1007). The reader is referred to those sections for the exact language. We have also modified the railroad testing requirements to reduce the testing rate and clarify how the locomotives are to be selected. The reader is referred to §1033.810 for the new language related to railroad testing.

4.7 Test Procedures

4.7.1 Part 1065 Revisions and General Test Procedures

Given the very detailed nature of the comments we received on the proposed 1065 changes, we have addressed them is a separate document.[3]

4.7.2 Locomotive Test Procedures

4.7.2.1 General Locomotive Testing Issues

EMD commented that some of the Part 1065 specifications appear to be aimed at smaller engines. The commenter noted that while EPA recommends using laboratory exhaust tubing that has either a wall thickness of less than 2 mm or is air gap-insulated to minimize temperature differences between the wall and the exhaust, such specifications would not work for locomotive

3 "EPA Response to 1065 Test Procedure Comments Submitted in Response to the NPRM for Locomotives and Marine Engines", Chris Laroo, USEPA, Memorandum to Docket, January 22, 2008, (EPA-HQ-OAR-2003-0190-0846).

stack extensions, which can be as large in cross section as one foot by six feet. EMD recommended that EPA allow the use of thicker material, consistent with good engineering judgment, and of batt insulation around locomotive stack extensions, or around the exhaust stacks of locomotive or of Category 2 marine engines in test cells, to maintain wall temperatures near the exhaust temperature. The commenter also urged EPA not to become too prescriptive with regard to transfer line length or insulation requirements. EMD commented that it is concerned about being able to continue to test the large engines that EMD produces, and note that the large range of engine sizes and applications that is covered by the procedures of Part 1065 dictates that a solution that might work for one engine could be unworkable for another.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1

Our Response:

The existing Part 1065 regulations are intended to allow testing for engines of all sizes. As part of this rulemaking, we also carefully reviewed Part 1065 to ensure that it specified procedures appropriate for locomotives and made revisions where necessary. Moreover, Part 1065 includes broad allowances to modify the test procedures if we agree with the manufacturer that such changes are necessary.

With respect to EMD's specific comment about wall thickness, we note that this is merely a recommendation, not a requirement.

4.7.2.2 Engine Testing

What Commenters Said:

Cummins supports EPA's efforts to improve and clarify the testing requirements for individual locomotive engines certified in a test cell and recommends that the 'standard' notch setting for 'nonstandard' locomotive engine applications (table 1033.520(c)) be made applicable to engine families that are used in multiple locomotive applications.

EMA also supports the changes and simplifications provided in the revised locomotive test procedures. The commenter also expressed support for an allowance to test engines to percentage power levels versus specified notches to permit testing to be done in test cells on engines for which the final application is not known.

EMA also noted that EPA has proposed dynamometer testing of a single engine used in a multiple engine locomotive application for certification testing and PLT (see §1033.520(f)). EMA agrees with this proposal. However, the language states that all operating points for the locomotive shall be tested. EMA recommends that the regulatory language specifically exclude engine start-up and shutdown emissions. This exclusionary language also is required to clarify the test methods for multiple engine locomotives.

Letters:
Cummins Inc. OAR-2003-0190-0559.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

We have added an interim provision to §1033.150 to further simplify engine cell testing through model year 2013.

We do not agree with comments asking that we add provisions to allow an engine manufacturer to certify engines without knowing the locomotive designs in which they will be used. The standards apply to the actual locomotives and in many cases the performance of the emission controls is very dependent on the locomotive design. However, we are adding a provision to allow manufacturers to "carry across" emission data from one certified locomotive family to a different family if the same engine is used in both families. The manufacturer must then demonstrate to us that the differences in the two families are sufficiently small that the locomotives in the untested family will meet the same applicable notch standards calculated from the test data. Finally, as described above in section 4.4.2, we are also finalizing the proposed allowance to initially certify a switcher family using nonroad engines based on test data collected under parts 89 or 1039.

4.7.2.3 General Locomotive Test Cycle

What Commenters Said:

SCAQMD noted that under the current proposal, transitional emissions and the accumulation of PM emissions in the exhaust stack are not measured by the Federal Test Procedure (FTP), since this procedure does not measure during the transition between test modes. The commenter noted that in locomotive emissions testing that it conducted, significant emissions were found when the locomotive was in a transient state between idle and a higher notch setting and an accumulation of PM in the exhaust system or 'souping' can result in significant PM emissions. The commenter stated that the PM is not emitted immediately, it accumulates until the next time the locomotive goes to a higher power setting and is emitted at that point. SCAQMD commented that since the amount emitted depends on the amount accumulated, it believes it would be more appropriate to attribute it to the idling period rather than the high-power operation when it actually comes out of the stack. The commenter stated that to ensure that the FTP accurately accounts for locomotives, it recommends that emissions during transient modes be considered and the effects of exhaust souping be considered.

CARB noted that EPA requested comments on revised provisions for testing, certification, and compliance. The commenter stated that current EPA test and certification methods are generally adequate for existing locomotives. However, the commenter noted that there are two areas that would benefit from improvement, including accounting for transition and cold start emissions; CARB staff believes that some adjustments should be made in the existing 40 CFR Part 92 locomotive emission testing to account for transient emissions.

Letters:
California Air Resources Board (CARB) OAR-2003-0190-0596.1
South Coast Air Quality Management District (SCAQMD) (0558.1)

Our Response:

We agree that emissions during notch transitions are potentially important. However, contrary to the comment, the proposed test procedure, which is being finalized, does measure emissions during notch transitions. See §§1033.515 and 1033.520.

We also agree that idle PM "souping" can be an issue for some existing high-emitting locomotives. However, we do not believe it will be an issue for locomotives certified to the new standards. Even Tier 0 locomotives will be required to eliminate nearly all oil vapor from the crankcase ventilation gases, and that should virtually eliminate the "souping" issue.

Finally, we disagree with CARB that the test procedures should include cold starts. Locomotives are shut down much less frequently than other diesel engines and when they shut down they cool much more slowly because of their size. Thus cold start emissions are less important than for other sectors. Moreover, including cold starts in our test procedure would complicate in-use testing because it would require that a locomotive be shutdown several hours before each test and forcibly cooled to room temperature.

4.7.2.4 Pre-Test Locomotive Idling

What Commenters Said:

EMD stated that EPA has not explained the reason for changing the time for the pre-test idle from 15 minutes maximum in Part 92 to 10 to 15 minutes in Part 1033. The commenter noted that the amended Part 92 requirement recognized that many engines have control system features that prevent the engine from coming to lowest idle speed until specific criteria are satisfied, commonly oil temperature limits. The commenter noted that since the lowest idle speed is also the first mode of the test procedure, there is no reason to wait for ten minutes to pass, as might be interpreted from the Part 1033 table, until the test procedure can be started. EMD recommended reverting to the "15 minutes maximum (after engine speed reaches lowest idle speed)" requirement of Part 92; this would allow for immediate starting of the Federal Test Procedure, and would expedite running of the emissions tests.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1

Our Response:

We have revised the regulations in response to EMD's comment. The final regulations specify different provisions for locomotives based on whether they include catalytic aftertreatment. For locomotives not equipped with catalysts, manufacturers may begin the test as soon as the engine reaches its lowest idle setting. For catalyst-equipped locomotives, the regulations still specify that the test must be started after 10 to 15 minutes of idle. This is because pre-test idling can impact the measured emissions, and allowing widely variable idle times would adversely affect repeatability. However, EMD is correct to note that a locomotive may not reach its lowest idle setting within 15 minutes. To address this, we will allow manufacturers to begin the test in normal idle mode if the engine does not reach its lowest idle setting within 15 minutes. When they start in normal idle, they would then run the low idle mode as the second mode.

4.7.2.5 Timing of Notch Changes

What Commenters Said:

EMD commented that it has two comments regarding provisions of paragraph 1033.510(c). EMD stated that it believes the language would seem to disallow stopping for analyzer range changes or draining, purging, zeroing and spanning, data downloads, or other requirements. The commenter also stated that paragraph 1033.510(c)(5) for discrete-mode steady-state emissions test states that proportional sampling of PM emissions begins at the beginning of each sampling period and terminates once the minimum time in each test mode is reached, with a tolerance of plus or minus five seconds. EMD stated that this paragraph seems to indicate that EPA wants the sampling time for PM testing to be 300 seconds for all modes except Notch 8 which would be 600 seconds. However, the commenter noted, the footnote in Table 1 of this section states that the "time in each notch and sample averaging period may be extended" (violating the tolerance requirement of §1033.510(c)(5) and the maximum mode time of Table 1) "as needed to allow for collection of a sufficiently large PM sample."

<u>Letters:</u>
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1

Our Response:

We have revised the regulations to clarify that actions such as zeroing and spanning analyzers is allowed between modes. We have also clarified that longer sample times are allowed. However, this allowance is intended only where needed to collected a larger PM sample.

4.7.2.6 Alternative Ramped-Modal Cycles

What Commenters Said:

EMD commented that the one or two second interval between the end of one phase and start of sampling for the next phase in the example provided by EPA is insufficient, unless some type of automated particulate filter changing system is installed. The commenter further stated that there is insufficient time to do zero and spanning, draining, and purging of the gaseous analyzers that should be done at this point. EMD recommended extending the time between phases as necessary to perform required tasks in preparation for the next phase.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1

Our Response:

Manufacturers are not strictly required to complete phase transitions within two seconds. That provision (finalized as §1033.520(e)(3)(iii)) was merely an example. Instead, manufacturers are required only to use good engineering judgment when transitioning between phases

4.7.2.7 Single Filter Testing

What Commenters Said:

EMA commented that it agrees with the strategy to increase PM filter loading for Tier 4-level engine designs by allowing the option of eliminating discrete mode filters for each individual notch setting as described in proposed section 1033.510. The commenter stated that this testing/sampling with a single PM filter used during all notch settings with a sample time for each notch setting calculated by an appropriate weighting factor (i.e., weighting factor multiplied by a minimum of 400 seconds) would eliminate the need for the individual notch DFs and notch caps for PM. The commenter also stated that PM measurements for certification, PLT, and in-use testing could all be completed under this same test procedure. EMA commented that, because the weighting factors differ for switch-duty cycle and line-haul duty cycle, the drawback would be the creation of two PM locomotive cycle tests; however, in order to reduce that testing burden, only one PM test should be required based upon the specific application (either switcher or line-haul) for which the locomotive will be commissioned.

Letters:
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

We disagree with the request drop one of the cycles for locomotives using this option. Note that this comment only applies for Tier 3 and earlier line-haul locomotives and Tier 2 and earlier switch locomotives, where such locomotives are certified to PM FELs below 0.05 g/bhp-hr. This option is not available for locomotives certified to higher FELs, and all later locomotives are subject to standards over only one cycle. We do not agree that running separate tests for these few locomotives is an unreasonable burden. Moreover, a manufacturer wanting to avoid repeating test could also set up its PM sample system to collect parallel PM samples during the same test.

4.7.2.8 Smoke Testing

What Commenters Said:

EMA commented that it supports the proposed smoke opacity testing provisions (see §1033.515), which have streamlined and simplified the process of smoke opacity testing, including the elimination of the normalization for smoke stack diameter.

EMD also stated that it supports EPA's proposal to eliminate the normalization requirement. The commenter also noted, however, that the requirements to orient the smoke meter light beam along the hydraulic diameter for non-circular stacks is still problematic. For the rectangular stack exits of EMD engines, the light beam may have to be oriented at twenty-five degrees to the long axis of the plume to pass along the hydraulic diameter, which could result in highly variable smoke readings.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

We have revised the regulations to address testing where it is difficult to align the beam to have a path length equal to the hydraulic diameter (such as a long narrow rectangular duct). The revised regulations allow the beam to be aligned to have a different path length, provided it is corrected to be equivalent to a path length equal to the hydraulic diameter.

4.7.2.9 Dynamic Brakes

What Commenters Said:

EMD stated that the requirement to test locomotives at the dynamic brake points is ambiguous and suggests that EPA modify the regulatory text to require manufacturers to test locomotives at the dynamic brake point that represents the largest portion of dynamic brake operation. The commenter noted that for most locomotives with multiple dynamic brake modes, that point will be the lowest engine speed and power mode.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1

Our Response:

We have revised the regulations to specify how to test when it is not obvious which dynamic brake setting represents worst case. Manufacturers may either measure emissions and power at each dynamic brake point and average them together, or measure emissions and power at the dynamic brake point with the lowest power.

4.7.2.10 Testing Temperature Range

What Commenters Said:

EMD commented that it supports EPA's proposal to narrow the temperature range for a valid emissions test to 60 to 105 degrees Fahrenheit.

MotivePower requested that EPA maintain the locomotive testing temperature requirement at the current minimum level of 45 °F. The commenter stated that it does not believe that EPA has presented any data to justify raising the minimum test temperature to 60 °F (§1033.504), and the commenter is concerned that this change will impact the number of days per year that it can perform locomotive tests. The commenter stated that, at a minimum, this raised minimum temperature requirement will add administrative overheard that could significantly reduce its opportunity in the locomotive emissions testing market.

<u>Letters:</u>
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
MotivePower

Our Response:

One of the primary reasons we previously established a broad temperature range was to allow outdoor testing of locomotives. In implementing the prior regulations, we found that the broad temperature range with correction, which was established to make testing more practical, was problematic. Given the uncertainty with the existing correction, manufacturers have generally tried to test in the narrower range being adopted here. Narrowing the range allows us to eliminate the temperature correction, which was a significant source of uncertainty. Nevertheless, we recognize MotivePower's concern. That is why we are allowing testing at lower temperatures, provided the manufacturer develops correction factors specific to their locomotive designs. Until such time as the manufacturers can develop their own corrections, we will allow them to use the temperature correction in Part 92 for tests conducted between 45°F and 60°F.

4.7.2.11 Alternator/Generator Efficiency for Locomotive Testing

What Commenters Said:

With regard to the request for comment on whether or not EPA should specify more precisely how to determine alternator or generator efficiency for locomotive testing, EMD noted that a requirement already exists in Part 92 that the alternator or generator efficiency must be specified at each test point, and that the means of determining the efficiency be described to EPA. The commenter urged EPA to require that efficiency be determined and applied separately for each test mode; as this has been its practice from the start of their emissions testing for EPA. The commenter stated that it has found that generator and alternator efficiencies can vary widely over the operating range of a locomotive engine and transmission, and accounting for the variation is important for accurate emissions determination. At the same time, EMD urged EPA not to be too prescriptive in specifying the means of determining alternator or generator efficiency, as testing of efficiency is involved and expensive. The commenter noted that in practice, the efficiency determinations are combinations of experimental data and analytical calculations. The commenter instead suggested that EPA institute a requirement that manufacturers make available for EPA inspection and audit their means of efficiency determination upon request. Lastly, EMD urged EPA to recognize that a manufacturer's efficiency information, including the method of efficiency determination, any computer programs used to streamline the process of efficiency determination for specific test modes, and the resulting efficiency figures themselves, are a manufacturer work product and are proprietary to the manufacturer. The commenter stated that it believes that EPA should not impose any requirement that manufacturers disclose such information to parties outside of the manufacturer or EPA, and should be prepared to treat any efficiency information as Confidential Business Information subject to the protections of 40 CFR Part 2.

GE commented that it believes EPA should specify the Institute of Electrical and Electronic Engineers' (IEEE) Standard 115 'Test Procedures for Synchronous Machines' as the test procedure for determining alternator/generator efficiency to ensure consistent and repeatable emissions test results regardless of the venue or entity performing the test.

<u>Letters:</u>
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
General Electric Transportation (GE) OAR-2003-0190-0590.1

Our Response:

We agree that the regulations should remain flexible at this time with respect to alternator/generator efficiencies. However, in response to GE's comment, we are revising the regulations to clarify that IEEE 115 is an appropriate method to determine alternator/generator efficiencies. Nevertheless, we will continue to allow other methods consistent with good engineering judgment.

4.7.3 Marine Test Procedures

4.7.3.1 Test Duty Cycles for Marine Engines

What Commenters Said:

EMA and Caterpillar commented that propulsion engines with controllable pitch propellers should be certified to the E2 cycle. They stated that larger marine engines with controllable pitch propellers operate more like the E2 duty cycle than the C1 duty cycle which was designed for nonroad machinery, and that use of the C1 duty cycle is inconsistent with IMO MARPOL 73/78 which uses the E2 cycle. EMA further stated that the C1 cycle is especially problematic for large engines which have little or no lug capacity causing the intermediate speed to be well below rated torque. This makes the cycle emission numbers (in g/bkW-hr) very high even though the actual emission rate in grams/hour at the intermediate speed is low due to the low power capability. Industry recommended that the C1 cycle should not be required for controllable pitch applications, but could remain an option for manufacturers.

EMA and Caterpillar commented that larger engines designed for use with controllable pitch propellers often have a combinator line (recommended maximum propeller loading at part speed) that is well below the cubic propeller curve used in the E3 duty cycle. Caterpillar provided an example of a combinator line which is the intended operation for propulsion efficiency and is a power limit intended to protect the engine. For this reason, industry recommended the E2 duty cycle for these engines. In later conversations, industry acknowledged that engine designs using controllable pitch propellers vary and expressed support of using the E3 duty cycle for engines that are designed to be able to operate on this test cycle.

Caterpillar recommended a method of distinguishing between engines using an E2 versus an E3 duty cycle based on the maximum part speed power limit line. The maximum part speed power limit line is defined as the manufacturer's recommended maximum power limit line at less than rated speed for operation for periods of a minimum of 30 minutes without interruption. The E2 test cycle would then be used if the maximum part speed power limit line is less than the cubic demand line through rated speed and power for any speed. Caterpillar explained that if the manufacturer's limit line for 30 minutes of continuous operation is above the cubic demand curve, then the limit line for unlimited operation is likely to be close to the cubic demand curve. As a result, the recommended combinatory curve will be closer to a cubic demand than to constant speed operation.

EMA commented that manufacturers currently design, certify, and perform durability testing on all marine engines less than 37 kW using the E3 duty cycle with no distinction between recreational and commercial applications. EMA expressed belief that the E3 duty cycle is representative of in-use operation of these engines and that there is no documentation validating that the 6-mode cycle is more representative of the marine engine applications. Therefore, EMA concluded that all engines less than 19 kW should continue to use the E3 duty cycle rather than the proposed G2 duty cycle and that manufacturers should not be required to use the E5 duty cycle in recreational applications for engines less than 37 kW. EMA also commented that marine engines between 37 and 75 kW are currently designed, certified, and durability testing using either the E3 or E5 duty cycle and that EPA should allow certification on using either the E3 or E5 duty cycle dependent on durability and operational mode data from the in-use application.

EMA commented that the E3 duty cycle should also apply to propeller-law auxiliary engines as currently specified in §94.105(b). They explained that the existing provision provided alignment with IMO Annex VI.

EMD identified two concerns about marine ramped-modal test cycles. First, the proposed regulations specify a mode order that is different from the requirements of 8178-4. Second, the specified mode order makes it more difficult to certify the same, or very similar, engines as both locomotive and marine engines. The commenter noted that the locomotive ramped modal cycle starts at low power and ascends, notchwise, to the rated power and speed of the engine. The transients reflect the orderly progression of power that might be applied by an engineer as the train accelerates. The large transients in the marine ramped modal cycles, by contrast, are likely to require additional development effort, and revised components, in order to cause engines originally designed for locomotives to conform to marine engine standards. EMD urged EPA to revise the mode order in ramped modal cycles for Category 2 engines to more closely reflect the mode order in ramped modal cycles for locomotives.

Letters:
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485, 0498, 0580.1, 0591.1, 0822
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502, 0594.1, 0662
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

Manufacturers pointed out two inconsistencies between the proposal and existing requirements for marine engines. These inconsistencies included the proposed duty cycles for marine propulsion engines less than 37 kW and the proposed duty cycle for propeller-law auxiliary engines. We agree that the existing E3 duty cycle should be used for these applications and have corrected this in the final rule.

We agree with manufacturers that the C1 duty cycle was not designed to represent variable-speed propulsion engines intended for use with variable-pitch or electrically-coupled propellers. Caterpillar provided an example of a power curve for a variable-speed engine designed to operate with a controllable pitch propeller where the operation is limited at low and mid-range speeds. In this case, we agree that the E2 test duty cycle, combined with the NTE requirements, is more representative of the operation of this engine than the proposed C1 cycle. For this engine, the power and torque at the C1 intermediate speed is relatively low, leading to a heavy weighting of low power operation. In addition, the power limit curve, for overload protection, is at lower power than even the E3/E5 duty cycles.

Controllable pitch propellers are also used with variable speed engines that have power curves that are more similar to those seen for nonroad engines or marine engines used with fixed pitch propellers. We are concerned that the E2 duty cycle would not be representative of the operation of these engines. Therefore, we are finalizing the E3/E5 duty cycles for variable-speed propulsion engines intended for use with variable-pitch or electrically-coupled propellers. In the case where the engine is not capable of operating over the E3/E5 duty cycle in-use, the E2 duty cycle would be used. For the purposes of this requirement, we consider an engine capable of operating over the E3/E5 duty cycles if the engine is intended to be able to operate for at least 30 minutes, continuously, at the power specified in the E3/E5 duty cycles at 63, 80, and 91 percent of maximum test speed. (See §1042.505(b)(1).)

Although variable-speed engines with controllable pitch propellers may operate at speed/power operation off the E3/E5 or D2 cycles, we believe that this option is captured by the NTE standards, described below, for variable-speed propulsion engines intended for use with variable-pitch or electrically-coupled propellers. We are not finalizing an option for using the C1 duty cycle for these engines except in the case where the engine is certified to the nonroad standards and is simply dressed, without affecting emissions, for use in marine applications. We are concerned that this option will add complexity to the test program and provide an incentive for manufacturers to pick and choose which engines will perform better on the C1 duty cycle.

Table 4.7.1 presents the final test duty cycles for marine engines. The designations for the test cycles are based on those given in ISO 8178-4.

Table 4.7.1: Test Duty Cycles for CI Marine Engines

Use	Speed	Propeller[a,b]	Application	Power	Test Cycle
propulsion	variable	fixed, or E3 VP/EC	all	<37 kW	E3
		fixed, or E3 VP/EC	commercial	≥37 kW	E3
		fixed, or E3 VP/EC	recreational	≥37 kW	E5
		E2 VP/EC	all	all	E2
	constant	VP/EC (all)	all	all	E2
auxiliary	variable	non propeller law	all	<19 kW	G2
		non propeller law	all	≥19 kW	C1
		propeller law	all	all	E3
	constant	all	all	all	D2

[a] VP/EC means variable-pitch or electrically-coupled propellers.

[b] E3 VP/EC means capable of operating on E3 propeller curve, else, E2 VP/EC.

With respect to EMD's comment, the order of modes in the ramped modal cycle for marine engines was intended to be consistent with the ramped modal cycles for other nonroad engines in Part 1039. At this time, we believe that consistency with Part 1039 is appropriate and thus are finalizing the cycle as proposed. Nevertheless, we will continue to monitor this issue as more manufacturers begin to use ramped modal cycles and may reconsider the order in a future rulemaking. In the mean time, since the ramped modal cycle is optional, manufacturers that do not approve of the cycle will not be required to use it.

4.7.3.2 Engines Used in Multiple Applications

What Commenters Said:

EMA commented that a given engine that is used in multiple applications would have to be tested over multiple duty cycles under the proposal. EMA commented that testing a given engine over multiple test cycles would be burdensome. Under this scenario, EMA expressed concern that engines in the same family rated more than 19 kW could operate in any one of the 6 possible test modes for over 19 kW marine engines. They argued that this is an entirely disproportionate testing burden considering that nonroad engines, of which there are many more produced annually having many different types of uses, are all tested on one test cycle, the C1 test cycle. Manufacturers commented further that all heavy-duty on-highway engines are tested on identical cycles, regardless of vehicle type or service class.

Therefore, EMA proposed the following: marine engines should be certification tested on the test cycle that represents the most common use of the engines in the engine family based on engine sales. This is consistent with 40 CFR 86.094-21 (b)(5)(iii), which requires only one primary intended service class, based on sales. Similarly, in-use testing should be conducted in applications representative of the cycle used for certification testing. EMA also recommended that EPA adopt this proposal for Tier 2 engines as well.

Letters:
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

As described above, we are making changes from the proposed set of test duty cycles for marine engines. As a result, we do not believe that the final test cycles would result in a burdensome array of multiple tests for engine manufacturers. With these changes, an engine with a given calibration is unlikely to be used in multiple applications that require different test cycles. For instance, an engine used with both fixed pitch propellers and variable pitched propellers (or propeller law auxiliary applications) could be tested on the E3 duty cycle. Also, a propulsion engine certified as a commercial engine may be used in both commercial and recreational applications. Many other applications require a unique calibration, such as engines used with variable-pitch or electrically-coupled propellers approximating the E2 cycle, and would require an emission test specifically for this calibration. In the case of a constant speed engine used for both propulsion and auxiliary applications, the E2 test modes are contained within the D2 test cycle and do not require additional testing. In addition, the final test procedures for auxiliary engines do not result in a change from existing requirements

4.7.3.3 Maximum Test Speed

What Commenters Said:

EMA noted that the NPRM uses the definition of Maximum Test Speed from Part 1065. For engines less than 37 kW, the maximum test speed was defined in Part 89. Under the proposal, effective in 2009, engines less than 37 kW would have to be designed and certified to an alternate definition of maximum test speed. EMA requested that sufficient lead time would be needed to allow implementation of the changes that will take place for nonroad engines in 2008, and to allow for the transition of those changes to marine engines less than 37 kW. In this regard, EMA stated that sufficient lead time would be 2 years, suggesting that the effective date for the definition of maximum test speed should be 2010.

Letters:
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

We believe that this is a reasonable request given the timing of the Tier 3 standards for marine engines less than 37 kW. Therefore, manufacturers will have the option to use the existing definition of maximum test speed, in Part 89, until the 2010 model year.

4.7.3.4 Maximum Test Power

What Commenters Said:

EMD commented that it believes that the Part 94 provision in which EPA defined maximum test power for Category 2 engines as 90 percent of the power output observed at maximum test speed with maximum fueling rate is a result of a miscommunication during a conversation between EMD and EPA during the development of the original Part 94 rule, and EMD urged EPA to correct this for Part 1042. The commenter noted general practice in the Category 2 engine market to provide engines with two power ratings, and stated that it believes that maximum test power for Category 2 engines should be defined as the power output observed at maximum test speed with maximum fueling rate, without the 90 percent factor. The commenter stated that it believes this would make the Category 2 maximum test power consistent with the maximum test power for Category 1 engines. (For constant-speed engines, maximum test speed would be the rated speed and maximum test power would be 110% of the continuous rating at that speed. For propeller-curve engines, maximum test speed would be the propeller curve speed necessary to develop the required power and maximum test power would be 110% of the continuous rating. For variable-speed and variable-load engines, maximum test speed would be that set by the engine control system and maximum test power would be 110 percent of the continuous power rating.)

Caterpillar commented that the current definition of maximum test power is different for Category 1 and Category 2 marine engines. For Category 1 engines, maximum test power is power output at maximum test speed with the maximum fueling rate possible. For Category 2 engines, the maximum test power is adjusted by a factor of 90 percent. Caterpillar commented that the use of the 90 percent adjustment factor is inappropriate for many Category 2 propulsion engines. The commenter stated that this is appropriate for manufacturers that follow the practice of providing a demonstration of 110 percent of the rated power for each engine. However, other manufacturers set the fuel limit at rated power. Caterpillar recommended that the maximum test power should be the maximum power output observed in the case where the manufacturer's advertised rated power is equal to the nominal fuel stop power.

<u>Letters:</u>
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485, 0498, 0580.1, 0591.1, 0822
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502, 0594.1, 0662

Our Response:

We finalized a definition of maximum test power for Category 2 marine engines to be the power output observed at the maximum test speed with the maximum fueling rate possible. This aligns the definition of maximum test power for Category 2 marine engines with that for Category 1 marine engines.

4.8 Test Fuels and Sulfur Adjustments

What Commenters Said:

The New York State Department of Environmental Conservation commented that it agrees with EPA's statement that fuel properties affect measured emissions, and it believes it is imperative that certification test fuel truly represent commercial fuel. The commenter stated that it believes that the 10 percent weight minimum aromatics requirement (§1065.703) is too low to represent commercial diesel fuel, and would tend to lead to an underreporting of PM emissions during certification. The commenter also stated that it believes that, to ensure representative certification emissions test results, locomotives and marine engines must be certified on the highest sulfur range diesel fuel that they are allowed to use in service. Lastly, the commenter stated that it does not believe that an additive PM correction factor (which the commenter stated was given without explanation of its derivation) would account for all emission effects associated with the differences between low sulfur diesel fuel (LSD) and ultra-low sulfur diesel fuel (ULSD).

EMA noted that the NPRM proposes that Tier 3 and later engines must be tested using ULSD. However, the commenter noted, the preamble states that ULSD could be available by 2012 in the market, while the Tier 3 standards are effective for marine engines less than 75 kW in 2009. The commenter stated that it believes that engine certification testing will not represent in-use applications and will undermine the utility of the certification data during this period. The commenter stated that ULSD for certification testing would ideally begin in 2014 with engine systems that are sensitive to sulfur content, and requested that all testing requirements start no earlier than 2012 when ULSD becomes commercially available.

MotivePower, Inc requested that EPA revise §1033.101 to make clear that ULSD is the Tier 2 certification fuel. The commenter stated that the Preamble is clear that the Tier 2 certification fuel is intended to be ULSD, however the proposed regulations require LSD as the Tier 2 certification fuel unless a correction factor is applied with ULSD test fuel.

EMD commented that the NPRM amends the existing Part 94 PM correction for test fuels outside the Part 92 2000-4000 ppm sulfur content range by adding a correction provision for tests run with LSD and ULSD—the provision allows adjustment of the PM results obtained from tests using fuel of less than 300 ppm sulfur to estimate those that would have been obtained at 2000 ppm sulfur. The commenter stated that it appears there's an omission of adjustment provisions for test fuels between 300 and 2000 ppm sulfur. The commenter questioned if this was intentional, and if the results from tests with sulfur levels in that range are to be left unadjusted. The commenter also noted that its testing indicated a correction for sulfur content only about fifty-five percent as large as that calculated by the equation in the proposed paragraph §94.108(d)(2)(ii); the commenter recommended the use of an equation derived from its own testing: $S_{PM\ adj}$ = 10.858(0.0020-FSF) (where, $S_{PM\ adj}$ = PM sulfate adjustment (g/kW-hr), FSF = Test fuel sulfur weight fraction). EMD also discussed the proposed adjustment factor of 0.07 g/bhp-hr in §92.12(i) for particulate results obtained with low sulfur diesel (LSD) or ULSD. EMD recommended adjustments to this factor in place of that proposed §92.12(i). Lastly, the commenter stated that it believes that EPA's proposed adjustment is overstated by a factor of approximately two to three of the sulfate particulate emissions change with a fuel sulfur reduction (in Draft RIA equation 3-4) may mean that EPA has overestimated the particulate inventory effect of its fuel sulfur reduction program by the same amount, if equation 3-4 is used in the calculation. EMD recommended taking the certification test fuel sulfur content all the way to ULSD, as the locomotives that would be certified using it will spend the majority of their lives on ULSD, or on fuel of higher sulfur content that has been contaminated somewhat after June 1, 2012.

<u>Letters:</u>
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1
MotivePower, Inc. OAR-2003-0190-0613
New York State Department of Environmental Conservation, Office of Air Resources OAR-2003-0190-0583.1

Our Response:

We disagree with New York's comment that the aromatics content specification in §1065.703 is inappropriate. It is important to note that this specification is a *minimum* value of 10 percent. We believe aromatics levels that low do occur for in-use fuels and that the minimum value is appropriate.

We agree with EMA that manufacturers should be allowed to use higher sulfur fuels as the test fuel for Tier 3 engines. We are modifying the regulations to allow this. However, no correction will be allowed for the effect of higher sulfur level on PM emissions.

We believe MotivePower's comment represents a misunderstanding of the regulations. The test fuel for the new Tier 2 standards under Part 1033 is ULSD, but the specified test fuel for locomotives certified to the old Tier 2 standards in Part 92 remains high-sulfur fuel.

We have revised our sulfate adjustment factors based on newer data, including those provided by EMD.[4] The new values are lower than proposed but higher than recommended by EMD. It is also important to note that manufacturer may continue to test using the specified fuel without correction.

Finally, we agree with New York that the use of ULSD instead of LSD can effect emissions in ways other than the effect on sulfate PM emissions. However, we do not believe manufacturers should be required to correct for them. We expect these effects to be quite small or even undetectable. In addition, we expect the engines in question to use ULSD most of the time.

4.9 Marine NTE

4.9.1 General Comments on Revisiting NTE Standards

What Commenters Said:

EMA commented that it strongly supports revisiting the applicable NTE requirements. The commenter noted that during the Tier 2 rulemaking, EPA recognized that the NTE requirements were directed primarily at the control of NOx emissions and that there was limited information available relating to the impacts of the NTE requirements on PM and CO emissions (the commenter cited an excerpt from the rule's 1999 analysis of comments). The commenter thus believes that the NTE standards should be focused on ensuring that "off-cycle" emissions are reduced in a reasonably proportional manner to the cycle-based numbers, and should only address off-cycle operations that are experienced for a significant amount of time. EMA further commented that it believes that including engine operations in the NTE zone that are only occasionally experienced on some vessels can frustrate the overarching objective of developing clean, reliable marine engines with low fuel consumption and low carbon dioxide emissions.

EMA commented that all marine diesel engines are turbocharged, except for the smallest engines, and most are very highly boosted. The commenter stated that the natural characteristic of a turbocharged engine operating along a propeller demand curve (cubic power demand with speed) is to have high air-fuel ratios at very low speeds where the bmep is low and the naturally-aspirated breathing capability of the engine is sufficient to provide the combustion air with little or no aid from the turbocharger. The commenter also noted that at high speed (and high load) on the cubic demand, the turbocharger is up at full speed and providing plenty of air for

4 "Analysis of Fuel Sulfur Conversion Rates in Locomotives", Charles Moulis, USEPA, Memorandum to Docket EPA-HQ-OAR-2003-0190-0852, February 20, 2008.

combustion, and the bmep is the highest at full speed on the propeller demand line, but the turbocharger is operating at high boost. Brake specific emissions (g/bkW-hr) increase for all species at lower loads, because friction becomes a greater percentage of the indicated mean effective pressure and injection systems designed to provide sufficient fuel at rated speed are run at a large turn-down.

Caterpillar commented that it strongly supports revisiting the NTE requirement. The commenter noted that during the Tier 2 rulemaking, EPA recognized that the NTE requirements were set up primarily around NOx, and that there was limited information available on particulates and CO. The cycle emission numbers take into account average vessel operation. Emission effects are due to average operation over a period of time from a number of emission sources. This is reflected in the structure of the ambient air quality standards with long averaging times (hours to days to annual). The cycle limits should be the primary emphasis of the emission control effort. The NTE requirements should not be the stringency-setting portion of the rule. The commenter stated that some sort of NTE approach may be useful for making sure that the off-cycle emissions are reduced in a manner reasonably proportional to the cycle numbers, and the NTE should only address operation off-cycle that is seen for a significant amount of time. The commenter further stated that it believes that occasional operation will not be significant from an air quality standpoint. Including operation in the NTE zone that is only occasionally seen on some vessels distracts from the desirable goals of having clean, reliable marine engines with low fuel consumption and low carbon dioxide emissions. Caterpillar noted that EPA and industry have been able to examine the NTE issue in much more detail and there is much more information than was available in the previous rulemaking that established the original zones and factors, which were based on very limited data.

Environmental Defense, NRDC, et al. commented that they strongly support the proposal to close the gap in emissions control technologies and real-world emissions performance between commercial marine diesel engines and other similarly-sized diesel engines. The commenters also stated that they support the introduction of a strong NTE limit on all marine engines, just as emissions from highway and nonroad diesel engines are now capped by such NTE limits.

<u>Letters:</u>
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485, 0498, 0580.1, 0591.1, 0822
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1
Environmental Defense, et al. OAR-2003-0190-0592.1

Our Response:

Since the NPRM, we continued to engage the manufacturers to seek better understanding of these issues. We agree with the comments that some additional work was needed on the proposed NTE requirements to better address specific engineering issues related to marine engines. As discussed in the remainder of this section 4.9, we modified the proposed NTE zones and standards to address these issues, while maintaining the basic structure of the proposal and achieving the same effectiveness as the proposed NTE requirements. We also agree with comments supporting the need for the NTE limits.

4.9.2 Constant Speed Engines

What Commenters Said:

EMA commented that further review is necessary of the NTE zone associated with the D2 and E2 test duty cycles. EMA and Caterpillar commented that the proposed split between sub zones 1 and 2 seemed reasonable. Caterpillar stated that the proposed methodology for calculating the NTE zone would require engine mapping beyond what is necessary for performing the constant speed duty cycle testing. They recommended that the NTE zone definition be simplified to engine power above 40 percent of maximum test power. Correspondingly, they recommended dividing the sub zones at 70 percent of maximum test power for constant speed engines.

EMA and Caterpillar commented that the sub zone 1 NTE limits for constant speed engines appear to be reasonable. However, they recommended that the NOx limit be above 1.4 for sub zone 2 and that the PM and CO factor should be above 2.2. EMA and Caterpillar supported the proposed exclusion of a PM limit in sub zone 2 for engines with PM FELs at or above 0.07 g/kW-hr.

<u>Letters:</u>
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485, 0498, 0580.1, 0591.1, 0822
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

We agree that calculation of the NTE zone for constant speed engines would be simplified by using the approach recommended by industry. In addition, this approach does not significantly alter the basic shape of the NTE zone. Therefore, we are finalizing an NTE zone, for constant speed marine engines, that includes all operation above 40 percent of maximum test power at the governed speed. Sub zone 1 includes all operation above 70 percent of maximum test power at the governed speed. The remainder of the NTE zone for constant speed engines is denoted as sub zone 2.

Since the NPRM, manufacturers have shared additional information on the emissions characteristics of their engines. Using this additional information, we have further analyzed the feasibility of the NTE standards for Tier 3 and Tier 4 constant speed engines. Based on this analysis, we believe that slightly higher multipliers are appropriate for sub zone 2 of the NTE zone for constant speed marine engines. Therefore, we are applying the proposed Tier 4 multiplier of 1.5 HC+NOx to Tier 3 engines as well. Further, we are finalizing a limit of 1.9 for PM and CO in sub zone 2. We are also finalizing the proposed exclusion of a sub zone 2 PM limit for engines with an FEL at or above 0.07 g/kW-hr, which will apply to most Tier 3 engines.

4.9.3 Fixed-Pitch Propulsion Engines

What Commenters Said:

EMA and Caterpillar commented that they agree that the proposed NTE zone shapes are appropriate given the expected operation of engines used in fixed-pitch propeller applications and that it supports the adjustment to the NTE multipliers to account for the Tier 3 and Tier 4 duty cycle limits. EMA and Caterpillar commented that, given the inherent emission characteristics of marine engines, they strongly support the proposed changes to the NTE zone for fixed pitch propellers as a more accurate reflection of the operation of an engine in a marine vessel. The commenters noted that the previous NTE zone for fixed pitch propellers appeared to be based on a construction machine or on-highway vehicle engine, where the engine powered the vehicle through a transmission. EMA stated that it believes that the NTE factors for the fixed pitched application are much more representative of the operation of a turbocharged diesel engine compared to the Tier 2 rules. (EMA however stated that it believes that the factors remain lower than the data shows they should be, but that these factors are still much more accurate.) Caterpillar stated that it believes that the NTE factors for the fixed pitched application are much more representative of the operation of a turbocharged diesel engine compared to the Tier 2 rules, but that the factors remain lower than the data shows they should be. EMA and Caterpillar urged EPA not to eliminate or reduce the NTE factors for the Tier 4 standards. They stated that properly determined NTE factors will reflect the emission characteristics of engines and provide assurance that the overall emissions reductions expected from reductions in the cycle-based emissions are attained in real-world applications. EMA and Caterpillar commented that eliminating or reducing the NTE factors for Tier 4 would make the NTE portion of the rule the most stringent portion of the standard, as opposed to the cycle-based limits.

EMA commented that, for engines less than 75 kW, the NPRM creates separate NTE zone requirements for recreational and commercial propulsion engines. The commenter stated that it believes that multiple NTE requirements, and the possible requirement of the 6-mode test cycle for engines less than 19 kW, threaten to create a burden (presumably unintended) to design new marine engine products that perform to meet all these requirements. The commenter stated that it believes this burden is also increased since these smaller marine engine products are derived from nonroad engines that have their own unique NTE requirements. The commenter stated that it believes that any significant differentiation in the NTE requirements prevents the orderly transfer of technology that is necessary for meeting the proposed stringent Tier 3 standards. EMA recommended that the NTE zone based on the E3 duty cycle be used for engines less than 19 kW to create a static requirement that is representative of applications and moves towards a path of harmonization. The commenter also noted that a single NTE zone requirement is consistent with its request to use the 4-mode marine test cycle for all engines less than 19 kW. The commenter also recommended that the NTE zones associated with the E3 and E5 duty cycles be used for engines between 19 and 75 kW.

Letters:
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485, 0498, 0580.1, 0591.1, 0822
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

We are finalizing the NTE zones and standards associated with the E3 and E5 duty cycles as proposed. We believe that the proposed NTE zone and limits for these engines reflect the best information on in-use operation and anticipated emission control technology for marine diesel engines. As discussed above, we are finalizing the use of the E3 and E5 duty cycles for fixed-pitch propulsion engines ≥37 kW and the E3 duty cycle for fixed-pitch propulsion engines <37 kW. Therefore, the NTE zones based on the E3 duty cycle will apply to smaller engines and manufacturers should not experience any significant differentiation in the NTE requirements when transitioning to the Tier 3 standards.

4.9.4 Variable-Pitch or Electronically-Coupled Engines

What Commenters Said:

EMA and Caterpillar commented that the operation of marine engines is much different than that of nonroad equipment and recommended that EPA make a similar effort in addressing the NTE zone for other cycles as was made for engine operation with fixed pitch propellers.

EMA and Caterpillar commented that they believe that the proposed NTE zones and factors for variable speed and load applications and for constant speed marine auxiliary engines would make the NTE portion of the proposed standards more stringent than the cycle-based emission limits. The commenters stated that they specifically do not believe the proposed zones and factors reasonably reflect the PM and CO values that are observed from these types of engines. EMA commented that the NTE zones and factors for fixed pitch propulsion engines are somewhat representative of their operation, but that the factors proposed for variable speed and load engines and constant speed engines are not.

Working from the nonroad NTE zone, EPA and Caterpillar requested larger sub zone 2 which would include operation below a line extending from 50 percent power at the lower speed end of the proposed NTE zone (E speed) through 70 percent of power at maximum test speed. They also recommended higher NTE limits for subzone 2.

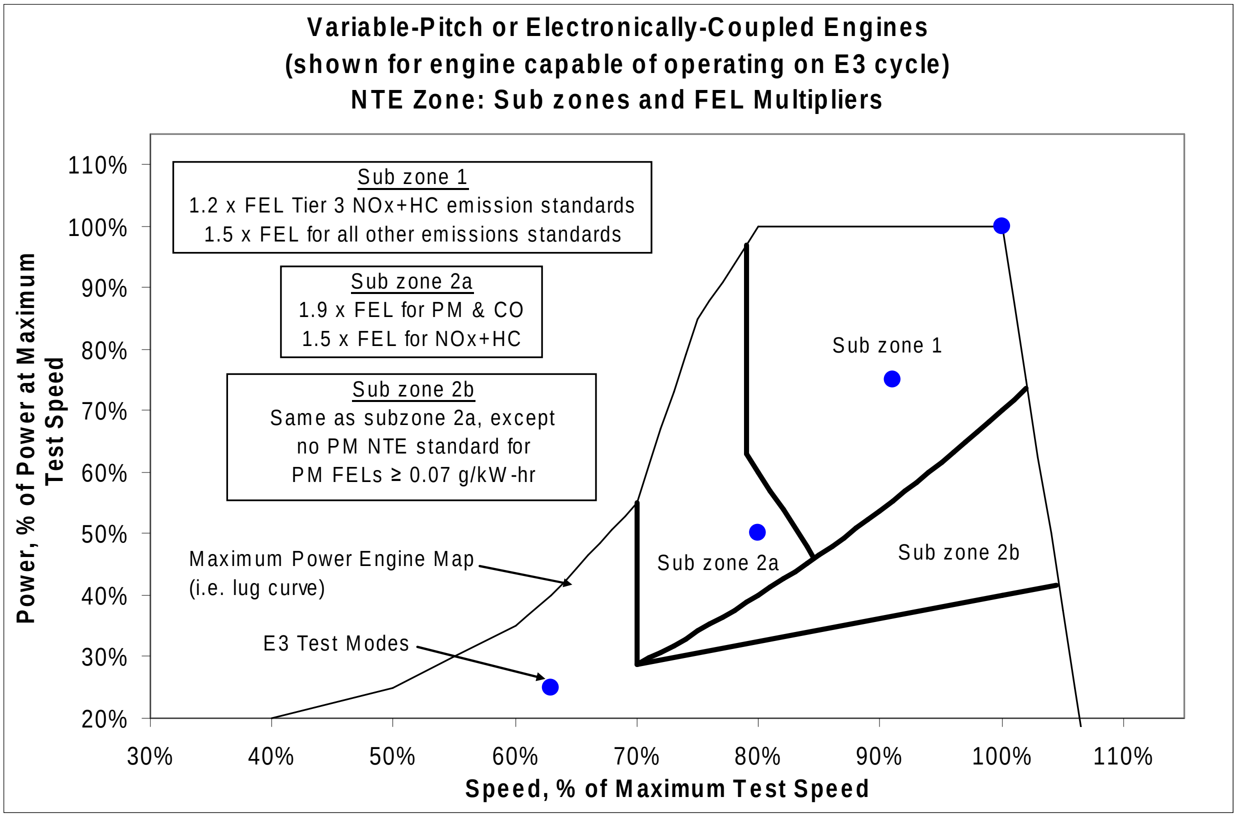
Letters:
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485, 0498, 0580.1, 0591.1, 0822
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

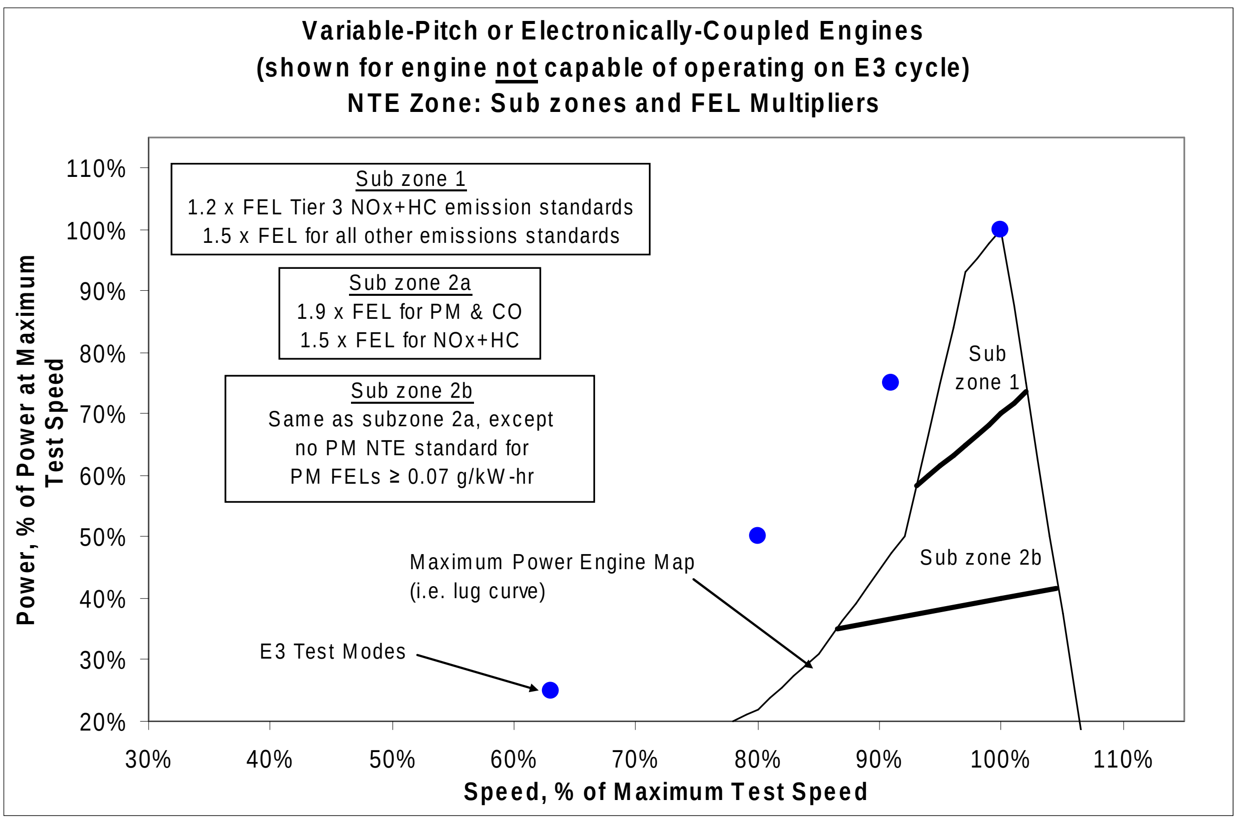
Our Response:

After the comment period, we continued to work with the marine engine manufacturers to better understand the unique characteristics of these engines. As discussed above, applications using variable-pitch or electronically-coupled engines vary greatly. In some applications, the engine may operate similar to a fixed pitch propeller engine and others more similar to a constant speed engine. In addition, some engines may operate over a wide range of speed and loads more similar to a nonroad engine.

With these engine characteristics in mind, EPA worked with industry to develop a revised NTE zone and limits that better reflect marine applications. To do this, we started with the proposed NTE zone and limits for engines certified to the E3 and E2 duty cycles. Specifically, we include the entire E3 NTE zone and all operation at power levels greater than the E3 zone to reflect the capability of engines to operate along the power curve. We also included operation below the E3 zone but above a line extending through the lowest power/speed corner of the E3 NTE zone and 40 percent power at maximum test speed. This lower power limit is consistent with the NTE zone for constant speed engines and was intended to capture the lower power operation presented in Caterpillar's comments.

Although a single NTE zone is used for all variable-pitch or electronically-coupled engines, this zone varies in appearance by power curve. For an engine capable of operating over the E3 duty cycle, it approaches the NTE zone for nonroad engines. In this case, the NTE limits are based on a comparison to the E3 duty cycle results. For engines that are not capable of operating over the E3 duty cycle, and are better reflected by the E2 duty cycle, the NTE zone and limits approach those for constant speed engines. In this case, the NTE limits are based on a comparison to the E2 duty cycle results. The following two figures present the NTE zone and limits and give an indication of how the shape of the zone is affected by the power curve of the engine.


Variable-Pitch or Electronically-Coupled Engines
(shown for engine capable of operating on E3 cycle)
NTE Zone: Sub zones and FEL Multipliers
Sub zone 1
1.2 x FEL Tier 3 NOx+HC emission standards
1.5 x FEL for all other emissions standards
Sub zone 2a
1.9 x FEL for PM & CO
1.5 x FEL for NOx+HC
Sub zone 2b
Same as subzone 2a, except
no PM NTE standard for
PM FELs ≥ 0.07 g/kW-hr
Maximum Power Engine Map
(i.e. lug curve)
E3 Test Modes
Sub zone 1
Sub zone 2a
Sub zone 2b
Power, % of Power at Maximum Test Speed
Speed, % of Maximum Test Speed
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
30%
40%
50%
60%
70%
80%
90%
100%
110%


Variable-Pitch or Electronically-Coupled Engines
(shown for engine not capable of operating on E3 cycle)
NTE Zone: Sub zones and FEL Multipliers
Sub zone 1
1.2 x FEL Tier 3 NOx+HC emission standards
1.5 x FEL for all other emissions standards
Sub zone 2a
1.9 x FEL for PM & CO
1.5 x FEL for NOx+HC
Sub zone 2b
Same as subzone 2a, except
no PM NTE standard for
PM FELs ≥ 0.07 g/kW-hr
Maximum Power Engine Map
(i.e. lug curve)
E3 Test Modes
Sub zone 1
Sub zone 2b
Power, % of Power at Maximum Test Speed
Speed, % of Maximum Test Speed
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
30%
40%
50%
60%
70%
80%
90%
100%
110%

4.9.5 Variable Speed Auxiliary Engines

What Commenters Said:

Manufacturers commented that propeller-law auxiliary engines should be certified using the E3 duty cycle. Manufacturer comments on the associate NTE zone for the E3 test cycle are discussed above.

Letters:
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485, 0498, 0580.1, 0591.1, 0822
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

For propeller-law auxiliary engines certified using the E3 duty cycle, the same NTE zone and limits will apply to these engines as for fixed-pitch propulsion engines certified using the E3 duty cycle. For other variable speed auxiliary engines, the proposed NTE zone will be applied. This NTE zone is the same as used for land based nonroad engines. In cases where the marine auxiliary engine has the same emissions design as the nonroad version of the engine, this will facilitate use of a single set of emission data for certification.

4.9.6 Governed Test Speed

What Commenters Said:

Regarding the NTE zone revisions (Part 1042, Appendix III), EMD commented that for the Propeller Law NTE Zone (Figure 1) and Variable Speed-Variable Load NTE Zone (Figure 4), EPA should make an allowance for the rightmost boundaries of the NTE zones for electronically-controlled engines to be a vertical line at maximum test speed. The commenter noted that the rightmost boundaries of the NTE zones are shown as a line with negative slope, running from 100 percent of both maximum test speed and maximum test power down to approximately 108 percent of maximum test speed at 20 percent of maximum test power. The commenter stated that this is characteristic of engines with hydromechanical governors, which reduce power as maximum speed is exceeded; the commenter further stated, however, that engines with electronic controls will follow a vertical line here as the control system will set a hard limit on speed that it will not allow the engine to exceed. The commenter noted that electronic controls are becoming widespread in the marine engine industry, and stated that it seems unlikely that it will be possible to meet the higher Tiers of emissions standards without them.

EMD also commented that for the Constant Speed Engine NTE Zone (Figure 3), there appears to be an error. The commenter noted that the NTE zone is shown as running along a diagonal line of negative slope from 100 percent of both maximum test speed and maximum test power down to approximately 108 percent of maximum test speed at 20 percent of maximum test power. The commenter stated that the NTE zone that is shown is a variable-speed zone for a constant-speed engine; and the commenter believes that the NTE zone should run along a vertical line at 100 percent of maximum test speed.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502, 0594.1, 0662

Our Response:

The slope in the NTE diagrams is intended to represent governor droop for a mechanically controlled engine. When determining the test modes and NTE zones, this slope is based on the characteristics of a given engine. In the case of an electronically-controlled engine, this slope would generally be vertical. Therefore, no change is required to the proposed test procedures and NTE zones to address these comments.

4.9.7 Harmonization with ISO

What Commenters Said:

EMA stated that the International Organization for Standardization (ISO) recently adopted (in ISO 8178) the original EPA marine NTE zones as defined in Part 94. The commenter expressed concern that future misalignment in emissions standards and design requirements could result from the NTE zone differences in ISO 8178 and Part 1042. The commenter suggested that efforts be made by the appropriate parties to revise the ISO NTE zones so that they are aligned with those defined by Part 1042 once the rule is finalized.

Letters:
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

We will continue to engage in discussions related to ISO standards and will support the use of the new marine NTE zones.

4.9.8 Ambient Temperature

What Commenters Said:

EMA and Caterpillar commented that the lower temperature limit for locomotive testing was proposed to be 60°F and that this limit should be used for marine NTE testing as well.

Letters:
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485, 0498, 0580.1, 0591.1, 0822

Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

Existing requirements for marine NTE testing use a lower limit of 13°C (55°F) for the unadjusted temperature range. No rationale was given by commenters why this limit should be changed from 55°F to 60°F. We believe that the NTE standards are feasible in at temperatures as low as 55°F and are not making any change to this limit.

4.9.9 Barometric Pressure

What Commenters Said:

EMA noted that the requirements of proposed section 1042.51(c)(1) extend the NTE-zone ambient conditions to include barometric pressure as a parameter in addition to air temperature, water temperature, and air humidity. They commented that this adds unnecessary cost and test requirements to the marine engine industry. EMA stated that testing and verifying for NTE-zone compliance is already an expensive part of the emission testing program, and the more parameters that are added, the more testing is required. According to EMA's comments, the vast majority of marine engines will never leave sea level and will not experience the lower barometric pressure of higher altitudes. Therefore, EMA commented that the proposed §1042.515(c) should be revised and the barometric pressure range should be deleted.

<u>Letters:</u>
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485, 0498, 0580.1, 0591.1, 0822
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

Simply deleting the barometric pressure range in the proposed regulations would open the requirements to an unlimited range of barometric pressures. Setting a pressure range that could only be achieved at sea-level would preclude engine testing in laboratories at higher elevations. As a compromise, we are revising §1042.515 to specify a generally applicable low pressure limit that represents the pressure that may be seen at 1,100 feet on a low pressure day. We believe that this pressure range is appropriate to facilitate testing of marine engines. For on-board emission testing, it is unlikely that barometric pressures outside of the proposed range would be observed. However, manufacturers located at higher altitudes would have the option to test at lower pressures.

4.9.10 Exhaust Temperature

What Commenters Said:

EMA commented that it objects to the requirement that the NTE limits for NOx emissions should apply when exhaust temperatures are as low as 150 °C. EMA did not agree with EPA's rationale that this is possible due to the predominantly steady-state operation of marine and locomotive engines. EMA stated that the advantages of steady-state operation allow for more efficient NOx reductions, not improved catalyst operation at lower temperatures. EMA also stated that it believes that the marine and locomotive requirements should be based on the transfer of technology from on-highway and nonroad applications—applications which have an exhaust temperature limit of 250 °C. Caterpillar commented that it believes that the proposed NOx catalytic aftertreatment minimum temperature of 150 °C is not achievable, even with robust SCR systems. EMA and Caterpillar objected to any NTE threshold requirement other than 250 °C for marine and locomotive engines. EMA and Caterpillar argued that the minimum temperature for the effective operation of SCR systems can be dependent on fuel sulfur levels. EMA and Caterpillar also commented that marine engines can be operated on fuels with sulfur levels significantly above 15 ppm during fuelings and operations outside of the U.S. (engines burning residual fuel could subject the catalyst to fuel sulfur levels above 10000 ppm), which will subject the catalyst surfaces to higher than recommended fuel sulfur levels, thereby requiring higher (not lower) minimum temperatures.

EMA and Caterpillar commented that they agree with the proposed requirement that the NTE limits for hydrocarbons should apply at a minimum temperature of 250 °C; they stated that the same minimum temperature of 250 °C also should apply to the NTE limits for PM as well. EMA and Caterpillar commented that the required PM reductions will need to include the organic fraction, and noted that many engines have a significant portion of the particulates from the organic fraction (as stated at 73 FR 15980). They reasoned that the organic fraction is reduced by oxidation of the hydrocarbons, and thus stated that the NTE requirements for PM should be based on the same minimum exhaust temperature that is required for the oxidation catalyst. EMA and Caterpillar further suggested that the temperature exclusions for EGR that are set forth in the Nonroad Diesel rule should be included in the marine and locomotive rules.

Letters:
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485, 0498, 0580.1, 0591.1, 0822
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

Based on recent research and development in urea dosing technologies that has shown that it is possible to hydrolyze urea-water solutions and create ammonia at lower temperatures than was previously observed, we proposed 150 °C as the low temperature limit for NOx for NTE testing. However, we now believe it would be appropriate to set the low temperature limit at 250 °C for NOx as well as HC, CO, and PM, to remain consistent with our on-highway and nonroad regulations (see 40 CFR 86.1370-2007 (g)), and allow for technology transfer from those sectors.

4.9.11 Stabilization within the NTE Zone

What Commenters Said:

EMA also recommended that the NTE provisions specifically account for the anticipated use of passively regenerated metallic substrate filters (metallic substrate filters in-use today rely on passive regeneration). The commenter noted that following periods of extended idle or light load or low temperature operation, exhaust temperatures must be sufficiently high to allow for filter regeneration; and once regeneration is completed, the filter is then operating at full efficiency. The commenter suggested that provisions be added to the rule to limit NTE requirements to periods after such regeneration has occurred.

EMA and Caterpillar stated that NTE testing should be excluded for a specified period (20 minutes minimum) after operation at loads below the NTE zone for periods of more than 5 minutes. The commenters argued that this will help prevent the build-up of particulate and HC on the exhaust piping during low-load operation and their subsequent release at higher loads, temperatures and flow rates, which could produce an artificially high emission reading within the NTE zone. The commenters also expressed the possibility of inaccurate measurements from the shedding of accumulated particulate in the exhaust stack due to higher temperatures and flows even if the previous operation was within the NTE zone. EMA stated that inaccurate measurements due to particulate accumulation during operation at some points and particulate shedding at other points are very likely, and specific guidelines are therefore necessary to address these important testing issues.

Letters:
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485, 0498, 0580.1, 0591.1, 0822
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

Our understanding of PM filter technology is that the efficiency increases, not decreases, as PM collects on the filter. Build-up on the filter helps collect further PM and hydrocarbons from passing through. Therefore, a regeneration event is not required for the filter to operate at maximum efficiency. Particulate matter that may shed off the exhaust piping during testing would not be collected by the PM sampling equipment. A cyclonic separator is used in the sampling system to separate out large diameter PM agglomerations. Typically, the cyclone is designed to separate PM over 2.5 microns in diameter. Therefore, we do not believe that it is necessary to exclude operation in the NTE zone that occurs immediately after low load operation outside of the NTE zone.

4.9.12 Steady-State Operation

What Commenters Said:

EMA and Caterpillar requested further clarification regarding the NTE testing restriction excluding the time when the operator changes demand (§1042.101). The commenters stated that there should be a clear statement that a period of time should be permitted to allow the engine to reach steady-state conditions.

Letters:
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485, 0498, 0580.1, 0591.1, 0822
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

The proposed test procedures for steady-state testing stated that the sampling period may not begin until the engine has reached stable operating temperatures. An example is given that this would include only engine operation after starting and after the engine thermostat starts modulating the engine's coolant temperature. We believe that this language provides a clear statement that a period of time is required to allow the engine to reach steady-state conditions. Therefore, no changes have been made in response to this comment.

4.9.13 Guidance for Certification

What Commenters Said:

EMA noted that EPA issued NTE guidance for marine engines under Part 94 in the form of a "Dear Manufacturer Letter" (see CD-03-15); and requested that EPA create similar NTE guidance for engines regulated under Part 1042 so that engine manufacturers can verify compliance in a reasonable and consistent manner.

Letters:
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

We believe that this request is reasonable and will work with stakeholders to provide similar guidance during the implementation of this rule.

4.9.14 Limited Testing Regions

What Commenters Said:

EMA stated that it agrees with the proposed limited testing region allowance for marine engines that already exists for on-highway and nonroad programs. Caterpillar commented that limited testing regions (LTRs) should be allowed anywhere in NTE zone and not be required to be along the NTE boundary. They stated that the LTR is only needed for PM.

Letters:
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485, 0498, 0580.1, 0591.1, 0822
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

We are finalizing the LTR provision which would allow a manufacturer to petition the Agency to limit testing in a defined region of the NTE engine control zone during NTE testing. This optional provision would require the manufacturer to provide the Agency with in-use operation data which the manufacturer could use to define a single, continuous region of the NTE control zone. This single area of the control zone must be specified such that operation within the defined region accounts for 5 percent or less of the total in-use operation of the engine, based on the supplied data. We are concerned that if limits are not placed on the shape of the LTR, that this provision could be abused. To protect against gaming by manufacturers, the defined region must generally be elliptical or rectangular in shape, and share a boundary with the NTE control zone. This approach is consistent with existing provisions for on-highway and nonroad diesel engines.

4.9.15 Deficiencies

What Commenters Said:

EMA suggested that the marine engine NTE provisions include the same regulatory allowances for NTE 'deficiencies' that are allowed for heavy-duty on-highway and nonroad engines. (See 40 CRF §§86.007-1 l(a)(4)(iv); 1039.515(a); 1039.104(d); and 86.1307-2007(d).) The commenter noted that, given the inherently harsh nature of the marine environment, the significant challenges inherent in the scaling-up of the anticipated aftertreatment technologies, and the inherent priority on protecting for safe and uninterrupted engine operation and performance, the potential availability of deficiencies should be extended to marine engines just as it is for other applications. EMA thus recommended that EPA consider providing more flexible deficiency allowances for marine engines, and also must ensure that any additional flexibilities that are provided for heavy-duty on-highway and nonroad engines are provided for marine engines as well.

Letters:
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

We have determined the feasibility of the NTE standards based on the data available and our analysis of this data, and we have not considered the availability or the in-availability of NTE deficiencies in making this determination. However, in certain instances, manufacturers may need additional time to address certain areas of the NTE zone. The availability of temporary deficiencies would help manufacturers make the transition to the new NTE requirements and standards. We are finalizing a temporary deficiency option for manufacturers similar to that which was provided for heavy-duty on-highway and nonroad engines. Under this program, manufacturers would ask us for the flexibility and would need to support why the deficiency is needed.

4.9.16 In-Use Measurements

What Commenters Said:

EMA and Caterpillar requested clarification regarding the manner in which NTE testing can be performed in-use due to the difficulty of obtaining accurate measurements of the very low levels of PM and HC dictated by the underlying very stringent emission standards.

Letters:
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485, 0498, 0580.1, 0591.1, 0822
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

As described in section 4.1.8 above, we are finalizing the regulations to include in-use adjustment for marine engines to help manufacturers deal with the transition to the Tier 4 standards, including any in-use testing. We believe that this addresses EMA's concern.

4.9.17 Implementation Dates

What Commenters Said:

EMA commented that, under the NPRM, the proposed NTE requirements for smaller marine engines would come ahead of the nonroad NTE requirements; the commenter stated that this could cause significant disruptions in the transfer of technology and force manufacturers to design separate marine engine lines. The commenter also stated that it does not believe that designing and accounting for the proposed NTE requirements could be completed by the proposed effective date of 2009. EMA requested that EPA align the effective dates of the proposed marine NTE requirements with those of the nonroad regulations to allow transition of NTE-based advancements from the nonroad sector, and to facilitate the necessary downstream transfer of emission control technology.

Letters:
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

We agree with this comment and have revised the final rule accordingly, such that marine engines will not be subject to NTE requirements before the nonroad engines from which they are derived.

4.9.18 Use of New NTE Provisions with Tier 2 Engines

What Commenters Said:

Caterpillar commented that the revised NTE zones and limits should be allowed for use on Tier 2 engine certification. They stated that this would allow a smoother transition into the new standards as manufacturers do new rating development before the Tier 3 standards apply. Correspondingly, Caterpillar commented that the duty cycles described above for engines used with controllable pitch propellers should be allowed for Tier 2 engines as well.

Letters:
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485, 0498, 0580.1, 0591.1, 0822

Our Response:

We believe that allowing the earlier use of the new duty cycles and NTE zones and limits would provide flexibility in making the transition to the new standards. Therefore, manufactures will be able to request approval for the early use of the duty cycles and NTE specifications that apply for Tier 3 or Tier 4 engines. We will approve these requests where the manufacturer can demonstrate that it would not affect compliance with the applicable emission standards. This generally would require that the combined provisions would result in better control of emissions or that combined effects of the procedures is small relative to the degree to which the engines are below the applicable standards.

4.9.19 Infrequent Regeneration During NTE Testing

What Commenters Said:

EMA noted that for engines equipped with infrequently regenerating aftertreatment devices, certification test changes in emission levels during regeneration events are accommodated by adjustment factors as determined in 40 CFR §86.004-28(i), §1039.525, and §1042.525. The commenter further noted that for on-highway engines, the impact of regeneration on NTE tests is accommodated by adjusting the averaging period in §86.1370-2007(d)(2). EMA noted that the on-highway allowances for nonroad engines are incorporated in §1039.515(a), and stated that it believes that this new rulemaking also needs to accommodate these changes—the commenter suggested that the following language be added to proposed §1042.515(a): "The provisions in 40 CFR 86.1370-2007 apply for determining whether an engine meets the not-to-exceed emission standards in §1042.101(c). Interpret references to vehicles and vehicle operation to mean vessel and vessel operation."

Letters:
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

We agree with the concept behind EMA's comment and have added a new paragraph (g) to §1042.515 to address this comment.

4.10 Other Issues

4.10.1 Plain Language

What Commenters Said:

EMD commented that it understands EPA's rationale for the structure of the 1000-series Parts of Title 40, but noted that it poses a difficulty for manufacturers. The commenter noted that separation of the compliance and test procedure parts from the standard-setting parts burdens manufacturers with monitoring rulemakings affecting sources unrelated to a manufacturer's own products. The commenter gave the example that when 40 CFR Part 92 was finalized, the testing procedures and the compliance provisions were set for locomotives and manufacturers would not be subject to modifications to those procedures unless and until a new locomotive rulemaking was undertaken. The commenter noted that with the new structure, whenever EPA undertakes a rulemaking activity, there is potential for modification of the testing and compliance procedures that could affect manufacturers of all sources. The commenter further gave the example that this will require manufacturers of locomotives and Category 2 marine engines to monitor and potentially become involved in rulemakings affecting other engines and equipment in order to be aware of (and possibly to comment on) changes that would affect their operations in order to maintain compliance. EMD urged EPA to give some thought to how it will make sure that all stakeholders are aware of activities under this new rule structure that could result in a manufacturer becoming noncompliant, not through ignorance, but through simply having missed a change that had taken place in rules affecting its operations. EMD also requested additional clarifications in another comment.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502, 0594.1, 0662

Our Response:

We understand the concerns raised by EMD, however we do not believe they warrant abandoning the new regulatory construct, which provides other important benefits. For example, for manufacturers that produce engines for more than one engine category, the new construct allows the use of common procedures across these categories.

All changes to these common regulations will be made only through public rulemakings published in the Federal Register. In addition, we generally make great efforts to reach out to all affected stakeholders in such rulemakings.

We have made clarifying revisions to the regulations where possible. It is also important to note that the proposed §§92.12(j) and 94.12(i) were included to provide manufacturers the flexibility needed to transition to the new regulations.

4.10.2 Gas Turbines

What Commenters Said:

The New York State Department of Environmental Conservation noted that marine turbine engines can operate on the same fuel as traditional diesel marine engines. The commenter stated that it believes that excluding turbine engines from regulation could have the unintended consequence of shifting the marine vessel power toward turbines, which could result in negating the emission reductions promised by this proposed rulemaking. The commenter stated that this concern also applies to Category 3 marine engines. The commenter suggested that it may be necessary for EPA to address marine gas turbine engines in a separate rulemaking, in order to avoid undesirable delay in this rulemaking.

Letters:
New York State Department of Environmental Conservation, Office of Air Resources
OAR-2003-0190-0583.1

Our Response:

We disagree with the assertion that we are excluding turbine engines from regulation. As noted in the preamble, we are addressing turbine engines in a separate rulemaking.

4.10.3 Non-OEM Remanufacturing and Part Suppliers for Locomotives

What Commenters Said:

The Coalition of Aftermarket Rail and Marine Engine Suppliers (CARMES) commented that t it believes the proposed regulations currently favor the OEM engine suppliers over aftermarket suppliers in a manner that places an unfair burden on the aftermarket suppliers. The commenter presented some additional points for EPA's consideration, such as: aftermarket suppliers are a $100+ million industry; there are thousands of employees in the aftermarket supply industry; these employees and businesses provide tax revenue and support local communities; and the new regulation will put a massive financial and resource burden on aftermarket rail and marine engine suppliers. The commenter noted that there has not been any feedback requested from any CARMES member company, and the commenter does not believe that it has had sufficient time for CARMES companies to study this issue. The commenter stated that it believes that the proposed regulations were influenced by OEM manufacturers who have lobbied for a one-sided regulatory environment. The commenter further stated that it believes that if the rule is implemented as proposed, competition in the market will be lessened substantially without offsetting economic or environmental benefit. CARMES commented that a solution is needed to preserve and encourage competition, and that as proposed, aftermarket suppliers and end users will be severely damaged by the rule. The commenter suggested that there should be integration of ideas to protect the interests of all, including CARMES and its members. The commenter believes that, without the aftermarket suppliers, there will be an OEM monopoly and a huge increase in the cost of part replacements for end users.

UNIPAR, Inc. (a CARMES member that submitted comments with CARMES, OAR-2003-0190-0650, p. 4), National Maintenance & Repair, Inc., Chromium Corporation, and Kaydon Ring & Seal, Inc. (Kaydon) also submitted comments similar to those of CARMES. These commenters also shared details of their specific situations. In addition, Chromium Corporation proposed that EPA should delay implementation of the proposed rule to 2010 and requested that the regulations allow a simple process to qualify parts or assemblies for substitution into certificate kits, including the following concepts to prevent aftermarket suppliers from being regulated out-of-business by new proposed emission regulations:

- OEM's should take the primary responsibility for developing new engines and retrofit kits for existing engines that meet emission requirements. The OEMs should be the primary certificate holders.
- Aftermarket suppliers should be allowed to treat the emission requirements for parts similar to the way they treat other factors such as performance, life, reliability and cost.
- Each part or assembly should be evaluated individually as to the extent that it may affect emission performance of each of the regulated pollutants.
- It should allow the demonstration that a part or assembly does not affect emission performance (example: head sealing gasket in a power assembly) or that a part or assembly is physically and functionally identical to the kit part or assembly and is, therefore, equivalent and cannot adversely affect emission performance. These parts or assemblies should receive a Certificate of Part Equivalence from EPA. These aftermarket parts or assemblies can then be substituted into any kit without threat of the primary certificate holder denying responsibility for the remaining kit components.
- If a part or assembly is different than the kit part or assembly, it may be necessary to demonstrate emission performance of the affected regulated pollutants through appropriate, but simplified, cost effective testing. Once the test results establish acceptable emission performance (equivalence or better) of the aftermarket part or assembly, and this data is presented to and accepted by EPA, the part or assembly will receive a Certificate of Part Equivalence, the part or assembly can then be substituted into any certificated kit without threat of the primary certificate holder denying responsibility for the remaining kit components.
- Any failure of emission testing must be evaluated to determine cause and the responsible party shall assume responsibility for remedying the problem.
- OEM and other certificate holders should not be permitted to discourage the substitution of any aftermarket part or assembly as long as with it has a Certificate of Part

Equivalence.

<u>Letters:</u>
Chromium Corporation OAR-2003-0190-0651
Coalition of Aftermarket Rail and Marine Engine Suppliers (CARMES) OAR-2003-0190-0650
Kaydon Ring & Seal, Inc. (Kaydon) OAR-2003-0190-0654
National Maintenance & Repair, Inc. OAR-2003-0190-0655

Our Response:

We have met several times with representatives of aftermarket companies since the proposal. We recognize the concerns raised by these small companies, and have revised our regulations to minimize any disruption. Specifically, the revised regulations include the following new provisions:

- We limit the total number of remanufactures that can be included under the pull-ahead provisions in 2008 and 2009 to 50-70 percent of the total number of remanufactures that occur during this period.

- We have included a component verification program in §1033.645. (See section 4.2.5, above.)

- We have added language to §1033.130 to limit the extent to which certificate holders may restrict the source of components for remanufacturing.

- We allow certifiers to use assigned deterioration factors during the pull-ahead period to shorten development time for competing remanufacture systems.

While we cannot guarantee that these provisions will prevent any change to the existing market, recent discussions with aftermarket companies indicate that these changes greatly reduce their concerns. Moreover, we believe the railroads have a strong interest in maintaining an active aftermarket for replacement parts as well as independent installers and sources of certificates.

4.10.4 Liability for Catalyst Manufacturers

What Commenters Said:

GE stated that catalyst manufacturers clearly could be categorized as a manufacturer within the meaning of the rule; and that, even though they may not hold certificates, their role in supplying perhaps the most critical emissions-related part of the locomotive indicates that they should bear as much or more liability than aftermarket parts suppliers that were the focus of the EPA determinations regarding liability in 1998. The commenter stated that it believes that catalyst manufacturers should bear the liability and recall burdens associated with the part of the locomotive control system that they supply, and that they can also be subject to warranty requirements under the rules because they can be classified as manufacturers. It also commented that it believes EPA should provide for a limited affirmative defense for owners/operators and locomotive manufacturers in the event of a catalyst failure to ensure that there are appropriate incentives for EPA to hold the catalyst makers liable for their failures. The commenter noted that EPA frequently provides affirmative defenses in Clean Air Act regulations to address the limitations of technology. GE suggested that, given EPA's proposal that the catalytic technology will not degrade more than 10% over the useful life, any further degradation should be the responsibility of the catalyst manufacturer and operators/manufacturers of the locomotive should be able to treat such an event as a malfunction-like occurrence.

<u>Letters:</u>
General Electric Transportation (GE)OAR-2003-0190-0590.1

Our Response:

The definition "manufacturer" in the Clean Air Act includes any person engaged in the manufacturing or assembling of new nonroad vehicles or new nonroad engines. As we described in section 4.2.5, we agree with GE's comment that all entities meeting that definition, including entities that are not certificate-holders, can have liability under the regulations. Both the Part 92 and Part 1033 regulations specify that a manufacturer of emission-related components can be considered to be a "manufacturer" for remanufactured locomotives under the Clean Air Act's definition. This was based on fact that it can generally be assumed for most remanufactured locomotives that there is no single "remanufacturer". However, we cannot conclude that catalyst manufacturers are categorically "manufacturers" for freshly manufactured locomotives under the Act's definition, but would consider the factual circumstances applicable to the specific case. In many cases, there is a single manufacturer that has near total control over the process. Therefore, we will not be providing an affirmative defense as requested by commenters.

4.10.5 High Horsepower Locomotives

What Commenters Said:

GE commented that it believes the rule should take into account the possibility of higher horsepower locomotives and include procedures for determining appropriate alternative emission limits. The commenter stated that higher horsepower locomotives would necessitate the specification of a different, alternate standard, a suggestion that is consistent with the methodology proposed for the marine rule. The commenter noted that limitations in size and weight in locomotives may dictate the degree to which the proposed technologies can control emissions in larger engines compared to current (~4500 HP) engines. The commenter suggested that the certification process for a larger engine should require an application to EPA justifying a proposed alternate certified emissions level to the standards applicable to today's locomotives. GE commented that, to ensure that an additional rulemaking would not be required to introduce a higher horsepower locomotive, it requests a provision specifically addressing the certification process of higher horsepower engines in the rule.

Letters:
General Electric Transportation (GE)OAR-2003-0190-0590.1

Our Response:

We do not believe that it would be appropriate to establish less stringent standards for locomotives that are not currently being marketed in the U.S. Moreover, we believe that the emission credit program is intended to address such special circumstances.

4.10.6 Head-End Power

What Commenters Said:

Caterpillar noted that some locomotives are equipped with a separate head end power engine for hotel load. The commenter requested that the final rule include an option for including the head end power unit in total locomotive power for determining emissions compliance, to apply to both the power for switcher definition and the cycle emissions calculations. The commenter stated, however, that it believes that the current provision of allowing the head end power unit to be a non-road certified engine without inclusion in the locomotive cycle emissions should be retained.

MotivePower, Inc requested that EPA add language to the regulation clarifying that dedicated head end power (HEP) units, common on passenger locomotives, are certified under 40 CFR, Part 89 and are not regulated under Part 1033 as auxiliary power units.

Letters:
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485, 0498, 0580.1, 0591.1
MotivePower, Inc. OAR-2003-0190-0613

Our Response:

As noted in section 4.4 above, we will allow head-end power to be considered in determining whether a locomotive is a switch locomotive. However, we do not believe we should allow the power from separate head-end engines to be included in emission calculations. MotivePower was correct to note that those engines are regulated under Part 89 (and will be regulated under Part 1039 in the future). We continue to believe that that is the correct policy. Caterpillar's request included no basis for concluding otherwise.

4.10.7 Definition of Owners Manual

What Commenters Said:

With regard to §1033.120(e), requiring that the emissions warranty statement be included in the locomotive owner's manual, EMD commented that locomotives generally do not have an owner's manual, in the sense that an automobile is furnished with such a manual that is delivered in the glove compartment. The commenter noted that it is usual in the locomotive industry to include the warranty statement in the sales contract for the locomotive; and the commenter urged EPA to continue to allow that means. The commenter further noted that it will provide a copy of its standard warranty statement, which includes both the commercial warranty and the emissions warranty, to EPA upon request.

<u>Letters:</u>
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502, 0594.1, 0662

Our Response:

Section 1033.901 defines "owners manual" to mean any written or electronic collection of instructions provided to ultimate purchasers to describe the basic operation of the locomotive.

4.10.8 EPA Access to Onboard Computer Information

What Commenters Said:

EMA stated that engine manufacturers object to the requirements of §§1042.110(b) and 1042.115(c) that would provide EPA access to proprietary engine information—the commenter suggested that these paragraphs be deleted.

<u>Letters:</u>
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

Section 208 of the Clean Air Act clearly authorizes EPA to require a manufacturer to provide information we may reasonably require to determine whether the manufacturer is acting in compliance with the regulations. Since EMA did not dispute that such data may be needed to determine if they are in compliance, there is no basis for dropping these provisions. EPA has on many occasions been provided with proprietary information and has special procedures for dealing with such information.

5. COSTS AND ECONOMIC IMPACTS 5-1
5.1 Engineering Costs 5-1
5.2 Cost Effectiveness 5-7

5. COSTS AND ECONOMIC IMPACTS

What We Proposed:

The comments in this section correspond to Section V of the preamble to the proposed rule, and are targeted at the costs and economic impacts of the program. A summary of the comments received, as well as our response to those comments, are located below.

5.1 Engineering Costs

What Commenters Said:

Tidewater Inc., (Tidewater) commented that the NPRM seems to insist on carrying forward the Highway model; one engine per vehicle. The commenter noted that there is no discussion in the rule under consideration about any sharing of exhaust treatment, not even for Tier 4 engines. The commenter stated that it believes that there may be possibilities of integrating some of the vessel's 'hotel' systems such as sanitary and or heating or cooling systems in such a way that could trap or otherwise reduce emissions and associated power requirements. The commenter also stated that it believes this option probably has not been explored since the vision of Engine and Environmental control manufacturers tend to focus on single engine packages. The commenter stated that the NPRM does not seem to allow for any such holistic solutions that may address emissions of the whole vessel, rather than each engine individually.

Tidewater noted that the design, fabrication, and operations of marine vessels entirely different from the model for locomotives. The commenter stated that it is not sure what the asking price of a locomotive is, but suspected that the cost of the diesel engine is about 90% of that cost, and that the locomotive is designed around the engine. The commenter then noted that on a typical maritime vessel the cost of the engine is closer to 10%. The commenter noted that it has seen costs for new construction vessels (talking about off-shore vessels (OSVs)) between $ 20,000,000 and $ 40,000,000, depending on capabilities. The commenter stated that it believes this inversion of cost ratios reflects a basic divergence in the importance of engines to vessel design between locomotives and commercial marine vessels.

The Engine Manufacturers Association (EMA) commented that care must be taken to ensure that the cost impacts of the marine engine emission standards to do not rise to the level where they threaten to undermine the ability of domestic vessel manufacturers and operators to compete effectively in the maritime industry. The commenter stated that it believes that the aftertreatment, fuel, and urea costs presented in the NPRM are understated—such that the total costs are likely to be much higher than indicated. The commenter stated that the impact of increased backpressure on fuel consumption is thus a key issue. The commenter noted that increased aftertreatment backpressure allows smaller aftertreatment systems but can cause higher fuel consumption, which implies that the increased backpressure expected from aftertreatment installations will increase engine fuel consumption.

EMA also stated that it completed a preliminary analysis of the potential cost impacts of the proposed Tier 3 and Tier 4 standards for marine engines. EMA worked with TIAX, LLC to construct an engine cost model that would take anticipated capital and operating expenses into account. This analysis focused on the engine cost impacts of the proposed Tier 4 standards, as applied to commercial marine vessels powered by engines greater than 600 kW. TIAX began by assessing what baseline engine-out emissions were likely to be before utilization of selective catalytic reduction (SCR) and diesel particulate filter (DPF) aftertreatment systems, and then analyzed the relative size and efficiencies (and thus costs) of the aftertreatment systems that would be required to meet the proposed Tier 4 standards. The commenter noted that the TIAX analysis focused solely on engine-related costs, not on the "additional and very significant" costs associated with redesigning and building new vessels to accommodate the anticipated Tier 4 aftertreatment systems. The cost analysis[1], focused specifically on three general applications of commercial marine engines - engines used in tugboats, ferries, and trawlers. TIAX made the following considerations for each of those applications: the size and efficiency of the aftertreatment systems that would be required, the component costs of those aftertreatment systems, the catalyst volume ratios, the catalyst filter lives, the urea consumption rates, and the impacts on engine maintenance and fuel efficiency. The commenter noted that pages 34-36 of the TIAX analysis (Docket Number OAR-2003-0190-0575.1, p.66) shows the modeled capital cost impacts on the three general applications of commercial marine engines.

EMA commented that the modeled capital cost impacts estimated by TIAX are significantly higher than the cost impacts presented in the proposed rule. The commenter specifically noted EPA's estimated per engine capital costs for compliance with the Tier 4 standards in 2016 ranging from $17,300 (for Category 1 (C1) engines) to $64,100 (for Category 2 (C2) engines) (72 FR 16018). The commenter noted that the TIAX cost analysis suggests that these capital costs may have been underestimated by as much as a factor of 3 to 5 on a per engine basis.

EMA commented that the TIAX cost analysis also assessed the engine-related operating cost impacts of the proposed Tier 4 rulemaking. The commenter noted that TIAX found (as did EPA) that urea costs will be the dominant operating cost occasioned by the aftertreatment-forcing Tier 4 standards. The commenter noted that TIAX projected (pp.37-39 of the TIAX report) urea consumption rates as high as 6.8% to 10.8% of the engine's diesel fuel consumption rate, whereas EPA projected a 4% urea consumption rate (Draft Regulatory Impact Analysis (RIA), p.5-62). The commenter also noted that a 1% fuel consumption penalty (due to higher exhaust back-pressures) was estimated in the rule, which is in line with TIAX's assessment. The commenter stated that, overall, the TIAX analysis equates the operating cost impacts of the Tier 4 standards (specifically, in the tugboat application) to a 4% fuel economy penalty, which equates to approximately $360,000 per year—which the commenter believes indicates that the operating cost impacts may double what EPA projected. EMA suggested that EPA reassess and

1 See Appendix D of EMA's public comments- docket numbers OAR-2003-0190-0584.1, 0585.1, 0586.1.

restate the cost analyses before finalizing the rule.

The Passenger Vessel Association (PVA) commented that it believes this rule will have a negative impact on the passenger vessel industry and small businesses. The commenter stated that the NPRM did not consider the costs of the proposed regulations on the ultimate consumer. The commenter further noted that the cost of new engines and in some cases, associated aftertreatment, falls squarely on the entrepreneurial, family-owned businesses of the passenger vessel industry. PVA stated that specific cost impacts on its members and industry at-large are known to be substantial but are not able to be estimated due to the lack of individual corporate and industry aggregate data. The commenter also noted that many of the small businesses represented in the industry are supported by ancillary non-seasonal businesses and other small business endeavors and related businesses using vessel business assets such as catering. The commenter stated that many public operations are supported, in part, through subsidies while private industry generally must cover expenses on a daily basis; and that both may be constrained to recover costs imposed by the rule by unsympathetic public utility commissions, unfavorable business cycles, and/or competition for discretionary spending (landside restaurants, amusements, museums, aquariums, etc). The commenter noted anecdotally that multiple operators have said that a good year is one where business is strong enough to pay off last year's loans and show enough profit to be credit-worthy enough to borrow in the upcoming off season.

General Electric Transportation (GE) also commented that it believes the Draft RIA substantially underestimated the cost of achieving the standards. GE noted that the proposal indicated that EPA relied heavily on the transfer of learning from the truck and nonroad sectors to reduce the costs for locomotive and marine engines. The commenter stated that, due to the unique nature of the locomotive application, and considering that a significant portion of the cost is operational, it believes that the ability to leverage the truck and nonroad sectors is limited. The commenter stated that in its analysis of the expected costs of compliance with the regulation, that analysis has highlighted areas where EPA either: (1) severely underestimated the cost; or (2) failed to identify costs that will be incurred. The commenter further stated that it believes that the Draft RIA and Notice of Proposed Rulemaking (NPRM) took little or no account of the significant redesign that will be required for the locomotive, the unique operating environment as compared to trucks, or the need for increased reliability (since trucks can break down and pull off the highway but trains cannot simply pull off the tracks).

GE commented that for its cost analysis, it used both fixed costs (engineering development, design, and validation of the new locomotive requirements) and operational costs (the cost of operating the locomotive throughout its life). GE commented that it believes that the research and development (R&D) costs estimated in the proposal are underestimated. GE estimates that, for GE only, the corporate R&D would be $20.6 million versus the EPA estimate of $14.9 million for the entire locomotive industry (note that the commenter's dollar figures are net present values at 3%). The commenter further stated that the engine-line research is also underestimated – GE-only for Tier 3, $12.0 million versus EPA estimate for the industry of $2.8 million; GE-only for Tier 4, $42.4 million versus EPA estimate for the industry of $5.1 million. GE also estimates $47.0 million for miscellaneous development where EPA estimated $2.1 million. In total, the commenter estimates the GE-only research at $124.3 million as compared to the EPA estimate for the entire industry of $27.1 million. The commenter also stated that it disagrees with EPA with regard to hardware costs and operating costs, with the GE-only costs estimated at $9.5 billion versus the EPA estimate for the locomotive and marine industries of $1.2 billion (note that these costs are net present values at 7%). The driver of the disparity here is attributed by the commenter to be the difference in DPF costs ($82,500 estimated by GE versus $62,600 estimated by EPA) and SCR costs ($153,000 estimated by GE versus $82,500 estimated by EPA) which result in a $1.5 billion difference between the commenter and EPA. The operating cost differential of $6.8 billion are attributed by the commenter to result from EPA underestimating DPF maintenance costs, overstating the DPF maintenance interval, ignoring SCR maintenance costs, underestimating urea consumption by 20%, and understating the urea cost ($2.27/gallon estimated by the commenter versus $1/gallon by EPA). The commenter argued that EPA includes no costs for overhaul of aftertreatment devices which, the commenter believes, will require some level of overhaul during their operational life. Finally, the commenter stated that EPA has underestimated the fuel impact by estimating the fuel consumption penalty at 1% versus 1.5% by the commenter, estimating the fuel cost at $1.28/gallon versus $2.20 by the commenter, and estimating no fuel impact due to the SCR system versus an 8% fuel consumption penalty necessary to compensate for SCR deterioration over time. GE noted that the statutory language that EPA invokes clearly requires standards to be achievable in light of the costs imposed and the time frame available to achieve them. Moreover, the commenter stated, EPA is required to consider the energy impacts - particularly where such impacts would increase greenhouse gases. GE further commented that it believes EPA's determination that use of SCR would not lead to increased fuel costs is facially invalid and must be corrected. Lastly, GE stated that, while EPA may well decide that the costs of a rule are outweighed by its expected benefits, it is inconsistent with the statutory language on which EPA relies to substantially underestimate the costs of a rule in making an achievability determination.

Letters:
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1
General Electric Transportation (GE) OAR-2003-0190-0590.1
Passenger Vessel Association (PVA) OAR-2003-0190-0576.1
Tidewater Inc. OAR-2003-0190-0557

Our Response:

With regard to the Tidewater comment about the NPRM insisting on carrying forward the highway model – one engine per vehicle. This is not the case. We are supportive of manufacturers finding inventive ways of complying with the emissions standards. This has always been our approach – to set performance standards rather than design standards thereby leaving the design open for ingenuity on the part of industry. For our cost analysis, it is simply most straight forward to estimate a set of aftertreatment devices for each engine rather than estimating how many engines may be "bundled" together to take advantage of a single large set of aftertreatment devices. This costing methodology by no means prohibits industry from doing otherwise provided they meet the standards.

GE commented that we had underestimated the R&D costs and pointed out that we relied heavily on a transfer of learning from highway and other sectors to the locomotive and marine sectors. GE disagrees with our expectation of such a transfer, but bases their disagreement on the fact that most of the costs are operating costs thus making the ability to leverage the truck and nonroad sectors limited. The comment does not address whether or not the transfer of learning could occur with respect to R&D, which is the only place we argued that the transfer would occur. Hence, we continue to believe that GE can, will, and probably already has learned from other industries. GE estimates their corporate R&D expense to be $20.6 million, versus our estimate of $14.9 million for the entire locomotive line-haul industry. What was not clear in our draft analysis is that we estimated corporate R&D expenditures by manufacturer and then allocated those expenditures across the market segments into which the manufacturer was expected to sell engines. As such, we actually had estimated that GE would spend $19.1 million on corporate R&D, or roughly $15 million discounted at 3%. We allocated half of GE's R&D to locomotive line-haul, and half to marine C2. We did the same with the other locomotive line-haul manufacturer, EMD. The result being the $14.9 million estimate allocated to line-haul. Therefore, once we compare the appropriate numbers, we actually estimated GE's corporate R&D to be $15 million while GE estimated their corporate R&D to be $20.6 million. Were we to eliminate our expectation for learning transfer, we would estimate GE's corporate R&D at roughly $30 million (3% net present value (NPV)). While we disagree strongly with GE's assertion that learning is unlikely to occur, we have adjusted our expected learning effects such that manufacturers selling only into the locomotive and marine sectors will incur 70% of the corporate R&D incurred for the 2007 highway rule while the draft analysis used a factor of 49% (70% x 70%). As a result, our corporate R&D estimates line up with GE's estimated corporate R&D. While we do not necessarily believe that this is a more correct estimate than that in our draft analysis, we prefer to be conservative. Note that we have made this change not only for GE but for any manufacturer that sells only into the locomotive and marine markets and is expected to have corporate R&D expenditures for Tier 4.

GE also provided details regarding what we termed "engine-line R&D" in our draft analysis, and they point out a considerable discrepancy between our estimate of $2.8 million and $5.1 million for Tiers 3 and 4, respectively (3% NPVs for the entire locomotive line-haul industry). In contrast, GE estimates GE-only costs of $12 million and $42.4 million for Tiers 3 and 4, respectively. According to our database, GE builds two engines, a 12 and a 16 cylinder engine that are, by our analysis, built on the same engine line given that both engines have 10.9 liters/cylinder so are, we estimate, built on the same engine line. Importantly, we estimated Tier 3 R&D of $1.6 million/line and Tier 4 R&D of $6.5 million/line. Therefore, we actually estimated GE's engine-line research at $8.1 million (~$7.4 million NPV at 3%). Clearly, our estimate is much lower than GE's, but we wanted to clarify our estimates and how they pertain to GE-only versus the industry. The EPA numbers pointed to by GE as industry estimates distribute costs over loco and marine engines which GE does not clarify in their comments. Based on GE's input and in the interests of being conservative, we have revised our final analysis such that both GE and EMD will incur engine-line R&D of $12 million and $42 million for Tiers 3 and 4, respectively (3% NPVs).

In their comments, EMA provided a breakdown of aftertreatment device costs for marine applications that differ from those estimated in our draft analysis. However, considerable differences exist between the two methodologies making comparisons difficult. Notably, EMA estimated no learning effects, as we did, and EMA estimated larger device volumes relative to the engine displacement than estimated by EPA. Note that, for the final analysis, we have revised our diesel oxidation (DOC) volume to engine displacement ratio to be 0.8:1 which is consistent with our technological feasibility write up (in the draft analysis, we used a ratio of 0.5:1). That change has little impact on our results or the discrepancy between our estimates and EMA's. The table below shows a summary of the EMA estimates along with our best attempt at presenting our costs in EMA's format to make comparisons easier.

Source	Engine displacement per EMA comments (L) →	34	107.5	164	277.5
EPA	Catalyst size (L)	85	269	410	694
	Catalyst+canning ($)	5838	17588	26621	44767
	Injectors (reductant dosing & controls)	1306	3070	4425	7148
	Housing & mixing duct (vessel hardware)	2666	2934	4141	4555
	NOx sensor	200	200	200	200
	Markup	1313	3319	4861	7959
	Total	11323	27112	40248	64629
EMA	Catalyst size (L)	136	430	656	1110
	Catalyst+canning ($)	3136	9915	15128	25594
	Injectors (reductant dosing & controls)	1500	3000	6000	10500
	Housing & mixing duct (vessel hardware)	7585	16710	18183	20200
	NOx sensor	3500	3500	3500	3500
	Markup	4716	9938	12843	17938
	Total	20437	43063	55564	77732

Discrepancies exist in the catalyst sizing where EMA estimated 4x engine displacement to our 2.5x, the catalyst+canning costs (where EPA is actually higher), and the reductant dosing systems (at least for the larger engines and larger SCR systems). But, the largest discrepancies exist in the housing and mixing duct costs (which we termed vessel hardware and SCR marinizing and did not include as SCR system costs in our draft analysis), the NOx sensor costs and markups. Regarding catalyst sizing, our cost estimate is consistent with our technological feasibility argument so we refer the reader to Chapter 4 of the Final RIA. As for the reductant dosing system, we believe that the controls for such should not vary by engine size so that the only varying cost should be the dosing hardware. Our cost estimates actually agree for the smaller systems, despite our lower SCR system volumes. However, for the larger engines, EMA's estimate doubles for a system only 52% larger than their 430 liter system, and then increases another 75% for a system 70% larger than their 656 liter system. By contrast, our estimates increase 44% for a system 52% larger and again 62% for a system 69% larger. It appears that this is a result of EMA's scaling of these systems with reductant volume flow by application rather than by engine size. Such an approach further exacerbates the difficulty of making a direct comparison of cost estimates. We also find it difficult to understand EMA's estimates for NOx sensor costs. These sensors need to measure NOx concentration and one per exhaust run would be sufficient. The sensors needed for marine applications (and locomotive applications for that matter), are not any larger than those needed for highway and/or nonroad applications where cost estimates of less than $200 are becoming the norm. Also, our markups are considerably different, with EMA's stated as a flat 30% without any detail as to what is covered by that markup. Our markups are detailed as labor overhead at 40%, warranty at a 3%

claim rate, manufacturer carrying cost at 4% and dealer carrying cost at 3%. Lastly, our estimates include learning factors (not presented in the table above) while EMA's did not. Our learning factors, which are consistent with most of our recent rulemaking cost analyses, result in costs decreasing by roughly 20% at each learning step. In our methodology, we estimated that one such learning step will occur before the Tier 4 standards take effect. That learning step is a result of our Tier 2 light-duty highway rule, our 2007 heavy-duty highway rule, and our nonroad Tier 4 rule. We then estimated yet another learning step two years into the Tier 4 standards. In contrast, EMA appears to have estimated no learning in their estimates despite several years between now and Tier 4 implementation. In the end, our estimates are consistent with what we are told in confidential meetings by suppliers, although this is a claim also made by EMA.

Similar comparisons can be made between the DPF and DOC estimates in our draft cost analysis versus those in the EMA comments. Again, the largest discrepancies are injector costs which EMA estimated to range from $1,500 to $4,500 per engine, depending on size, while we estimated no costs for injectors because we believe that DPF regeneration can be controlled via in-cylinder fuel controls. We also have the same type of discrepancies in what EMA terms housing and mixing duct costs, markup costs, and learning factors as described above for SCR systems.

GE also provided estimates for aftertreatment devices -- $82,500 for a DPF and $153,000 for SCR, both are per-locomotive costs – versus our lower estimates. However, GE provided no details, stating only that their estimates were based on input from the aftertreatment industry.

After reviewing and analyzing the comments and associated aftertreatment cost estimates, we continue to believe that our estimates are good and can see no reason to revise them, except in the area of vessel related costs associated with the aftertreatment devices. The EMA comments also included SCR-related costs at the vessel level. Those costs were also higher than our costs and included costs for reductant tank heaters, pumps, and a reductant dosing panel with controls. We believe that costs for these elements were not adequately characterized in our draft analysis and have included them in our final analysis. However, we still differ from EMA with respect to reductant tank size and related costs, where our costs are lower due, in part, to our estimate of a 4% reductant consumption rate (reductant consumption = 4% of fuel consumption) while EMA estimated a rate between 6.8% and 10.8%. Also, for our final analysis, we have removed the reductant tank and dosing controls from our SCR costs and included them instead in our vessel (or equipment) related costs. As a result, our SCR costs appear to have decreased slightly (due to removal of reductant tank, etc.) while our vessel (equipment) related costs have increased.

5.2 Cost Effectiveness

What Commenters Said:

The Northeast States for Coordinated Air Use Management (NESCAUM) commented that, according to its review of the Draft RIA, the combined NOx-PM reduction cost-effectiveness of the locomotive remanufacturing standard is approximately $456 per ton in the year 2020. The commenter stated that it believes the locomotive remanufacturing component of the regulation is extremely cost-effective, compared to other strategies available to the Northeast States.

Letters:
Northeast States for Coordinated Air Use Management (NESCAUM)   OAR-2003-0190- 0551.1

Our Response:

We agree with the commenter.

6 BENEFITS 6-1
6.1 Benefit-Cost Analysis 6-1

6 BENEFITS

What We Proposed:

The comments in this section correspond to Section VI of the preamble to the proposed rule, and are targeted at the benefits of the program. A summary of the comments received, as well as our response to those comments, are located below.

6.1 Benefit-Cost Analysis

What Commenters Said:

Tidewater Inc. (Tidewater) noted that the purpose of the Notice of Proposed Rulemaking (NPRM) is to reduce emissions. However, in practice, this is partly being achieved by engine manufacturers tuning their engines to produce lower emissions at the expense of peak engine efficiency. The commenter stated that the costs of this loss of efficiency will increase fuel consumption as much as 5% or more. The commenter also stated that this lower performance must also be accounted for in the design of future vessels through specification of larger engines and directly affects the marketability of our vessels in competition with foreign vessels not subject to the rules. The commenter questioned whether or not EPA did a cost benefit analysis on this impact of these regulations; and if the cost benefit analysis justifies "the increased fuel consumption, increased costs to consumers, and potential loss of jobs to foreign competition that is not subject to the rulemaking."

Environmental Defense, the Natural Resources Defense Council (NRDC), et al. noted that the Draft Regulatory Impact Analysis (RIA) demonstrated that the benefits of the proposed standards far outweigh the costs of compliance to affected industries and society in general. The total monetized benefits, based on published studies of PM-related premature mortality, are estimated at $12 billion in 2030, assuming a 3 percent discount rate (or $11 billion assuming a 7 percent discount rate).

The commenters noted this estimate does not include additional benefits that, if monetized, would substantially increase the benefits stemming from the adoption of the proposed standards. This estimate does not account for the significant benefits related to decreases in ozone, toxic emissions and nitrogen and sulfate deposition, as well as additional positive impacts from reductions in particulate matter (PM). The commenters believe that these benefits could be quite substantial, and should be quantified further and included in the final impact analysis for the rule.

The commenters stated that since diesel exhaust is a highly complex and variable mixture containing numerous carcinogenic compounds, it is difficult to quantify the cumulative health effects. The commenters cited the NRPM (72 FR 15956) and another study that suggest that unmeasured pollutants may have a significant contribution to adverse health effects. The commenters thus stated that they believe it is very likely that significant health benefits will accrue with reduced diesel emissions, beyond what has been quantified in the Draft RIA (OAR-2003-0190-0592.1, p. 42- Appendix B).

In particular, the commenters noted, the proposed rule acknowledges the important role that ozone can play in premature mortality but does not include ozone reduction benefit estimates in their final cost benefit analysis. A large body of published scientific research demonstrates the significant negative impacts of ozone on human health, and

The commenters also stated that recent research has also demonstrated the negative impact of nitrogen and sulfate deposition on ecosystem health and value. A recent study on only Adirondacks State Park found that New York State residents were willing to pay between $336 million and $1.1 billion annually to reduce negative ecosystem impacts driven by sulfate and nitrogen deposition. The proposed standards would contribute significantly to valuable efforts to reduce these harmful depositions across the U.S.

The commenters stated that, in the proposed rule, the monetized benefits from reductions in PM-related mortality and morbidity substantially outweigh the minimal costs. Monetized benefits are estimated at $12 billion in 2030, assuming a 3 percent discount rate (or $11 billion assuming a 7 percent discount rate), while the total cost of complying with the program is estimated to be $600 million in 2030. Prices of rail and marine transportation are estimated to increase by less than one percent.

The commenters stated that they support the conclusion that the cost benefit analysis shows substantially higher benefits versus costs. The commenters also highlighted that the benefits would be even more substantial and further outweigh the costs of compliance if the additional non-monetized benefits, particularly ozone impacts, were included, and strongly urge the Agency to include them in its final analysis. They stated that they agree with the finding that the estimate of benefits is likely conservative.

The Passenger Vessel Association (PVA) commented that it believes that EPA should address the total cost/benefit equation in its preamble discussion. The commenter noted that the NPRM seeks to reduce two classes of unfavorable emissions at a cost of increased fuel consumption, increased carbon dioxide (CO_2) generation, new or expanded fuel/urea distribution and production systems. The commenter stated that it believes that these and other factors may reduce the positive effects of this rulemaking through the detrimental impact on other environmental programs such as reduction of greenhouse gases.

A number of private citizens commented that they believe that, while cost objections to the proposal by the diesel engine industry are understandable, the costs to public health of not implementing the proposal are both greater financially for our society, and more compelling in nature - namely human suffering and loss of life. The commenters noted that, because the connection between diesel engine emissions and disease has been established, and because it is possible to reduce emissions, that becomes a mandate. The commenters stated that they believe that diesel engine industry representatives are commissioned to protect their bottom line and therefore must oppose any additional expense — be it 20% or 1%. Lastly, the commenters stated that they believe that this creates a societal dilemma where government leadership is needed to guide industry and to advocate for the health of the public.

Letters:
Passenger Vessel Association (PVA) OAR-2003-0190-0576.1
Tidewater Inc. OAR-2003-0190-0557
Environmental Defense et al OAR-2003-0190-0592.1
(*Environmental Defense and NRDC, along with the following organizations: American Lung Association, Carolinas Clean Air Coalition, Citizen Action- Illinois, Citizens for Pennsylvania's Future (PennFuture), Clean Air Task Force, Clean Air Watch, Clean Water Action (National), Clean Water Action Alliance of Massachusetts, Clean Water Action Connecticut, Clean Water Action Pennsylvania, Clean Water Action Rhode Island, Environment Northeast, Group Against Smog and Pollution, NJ Environmental Federation, Public Citizen Texas Office, Respiratory Health Association of Metropolitan Chicago, the Sustainable Energy and Economic Development(SEED) Coalition, U.S. PIRG.*)
Private Citizens (*various*)

Our Response:

EPA agrees that the total estimate of benefits associated with the standards does not include the full complement of PM, ozone, and air toxics-related benefits that, if quantified and monetized, would increase the total estimate of rule-related benefits. These benefits remain unquantified because of current limitations in methods or available data. For example, we have not quantified a number of known or suspected health effects linked with ozone and PM for which appropriate health impact functions are not available or which do not provide easily interpretable outcomes (i.e., changes in heart rate variability). Additionally, we are unable to quantify a number of known welfare effects, including reduced acid and particulate deposition damage to cultural monuments and other materials, and environmental benefits due to reductions of impacts of acidification in lakes and streams and eutrophication in coastal areas. As a result, we may underestimate the total benefits attributable to the implementation of the final standards.

Though omitted in the proposal for this rulemaking, we quantify and monetize the ozone-related health impacts associated with the final rule. This reflects EPA's most current understanding of the science surrounding ozone impacts on human health and welfare, consistent with the recent ozone criteria document and the analysis of the proposed ozone National Ambient Air Quality Standards (NAAQS).

Using the most conservative benefits estimate, the 2020 benefits outweigh the costs by a factor of 10. Using the upper end of the benefits range, the benefits could outweigh the costs by a factor of 25. Likewise, in 2030 benefits outweigh the costs by at least a factor of 10 and could be as much as a factor of 28. Thus, even taking the most conservative benefits assumptions, benefits of the final standards clearly outweigh the costs.

With regard to the comment that engine manufacturers are re-tuning their engines to lower emissions at the expense of peak engine efficiency, we address this issue elsewhere in this document. Please refer to Section 11.1.2 of this Summary and Analysis of Comments document for more information. The same commenter questioned if EPA was accounting for lower engine performance in the design of future vessels and if this would affect competition with foreign flag vessels (and ultimately be reflected in the cost-benefit analysis of the rule). This issue is addressed elsewhere in this document; please refer to Section 3.2 for more information.

With regard to the comment that the regulations target criteria pollutants at the expense of increased fuel consumption and CO_2 generation, please refer to Section 11.1.2 for a response.

7. SMALL BUSINESSES/SBREFA PROCESS 7-1
7.1 Small Railroad Definition 7-1
7.2 Exemptions for Small Locomotive Remanufacturers 7-5
7.3 Exemptions for Marine Small Volume Manufacturers 7-9
7.4 Other 7-10

7. SMALL BUSINESSES/SBREFA PROCESS

What We Proposed:

The comments in this section relate to the proposed provisions regarding small entities and the Small Business Regulatory Enforcement Fairness Act (SBREFA), described in Sections IV.A(14) and IX.C of the preamble to the proposed rule. A summary of the comments received, as well as our response to those comments, are located below.

7.1 Small Railroad Definition

What Commenters Said:

The Northeast States for Coordinated Air Use Management (NESCAUM) noted the request for comments regarding possible revision of the definition of small railroad to ensure that intercity passenger, commuter, and larger regional freight railroads (i.e., those with annual revenues exceeding $25 million) become subject to locomotive remanufacture requirements. NESCAUM commented that it believes that, while this approach will improve upon emission reductions available under current regulations, it fails to take full advantage of a very cost-effective strategy to reduce locomotive emissions from the in-use fleet. The commenter instead urged EPA to extend the remanufacture requirements to include all freight railroads, in addition to intercity passenger and commuter railroads. Under the present definition of small railroad (line-haul with 1500 or fewer employees; local and terminal with 500 or fewer employees), the U.S. railroad statistics (see docket number OAR-2003-0190-0551.1, p.3) show that only the relative few Class I freight railroads clearly are subject to remanufacture requirements by virtue of not qualifying for the small railroad exemption. NESCAUM noted that on average, commuter, regional, local, and switch railroads fall well below the employee thresholds, thereby avoiding remanufacture requirements. Applying a $25 million annual revenue threshold as the factor for defining small railroads would have the effect of bringing the 'average' regional railroad into the remanufacturing program (average revenue of $49 million, according to the table on page 3 of their comments), but would exclude many smaller regional freight railroads and likely almost all local and switch railroads.

The New York State Department of Environmental Conservation expressed that it does not agree with the proposal to exempt small railroads from Tier 0 remanufacturing requirements. The commenter stated that it does not see a disproportionate cost burden associated with small railroads complying with the remanufacturing requirements, and it therefore urges EPA to limit the remanufacturing exemption to locomotives for which no remanufacturing kit has been certified.

The New Jersey Department of Environmental Protection (NJDEP) noted that it has determined that all Class 2 and 3 railroad companies that operate in New Jersey will be excluded from the remanufacturing standards in EPA's proposed rule, if EPA retains SBA's definition of small railroad (500 or fewer employees for line-haul railroads, 500 or fewer employees for short-haul railroads). New Jersey has 11 small railroad companies that employ about 200 people and operate about 100 locomotives. As such, NJDEP suggested that, instead of defining a small railroad as one which has less than $25,000,000 in annual revenues (as proposed in the alternate options section), EPA should subject all railroads to the remanufacture standards, regardless of annual revenue.

Environmental Defense, the Natural Resources Defense Council (NRDC), Puget Sound Clean Air Agency, et al. commented that they support EPA's proposed change to a revenue based definition for a locomotive small business. The commenters also stated that they are in full support of the proposed clarification that "intercity passenger or commuter railroads are not included as railroads that are small businesses because they are typically governmental or are large businesses."

Rail World commented that it believes EPA has rightly recognized that the compliance with the proposed standards should exempt small railroads as defined by the Small Business Administration (SBA). This is in harmony with the previous rules establishing locomotive emissions. Small railroads in the United States seldom have the financial ability to purchase or lease new locomotives. Past practices of these small railroads usually result in those railroads purchasing locomotives cascaded out of the fleets of the Class I railroads.

In addition, Rail World indicated that it believes the revenue threshold that EPA solicited comment on should not be implemented in the proposed rules for many reasons. Revenues do not equal earnings, nor do they guarantee a return on investment. Many small railroads as defined today (line-haul railroads with 1,500 or fewer employees, and short-haul railroads with 500 or fewer employees) are marginal as compared to their Class I partners. Rail World believes that using revenues to determine if a railroad fits the definition of a small railroad should be rejected and omitted. The commenter also noted that the use of a revenue threshold of less than $25 million per year would be in conflict with other government agencies—the Surface Transportation Board (STB) and SBA's definitions; STB defines a Class I railroad as one with annual revenues of $250 million or more. Lastly, the commenter noted that in the NPRM, small railroads as recognized by the STB (revenues of less than $250 annually) would be placed into the same category as the Class I railroads if their revenues (and earnings) exceeded $25 million per year.

The American Short Line and Regional Railroad Association (ASLRRA) urged EPA to maintain the proposed remanufacturer exemption for small railroads. The commenter noted that at the May 10, 2007 hearing NESCAUM suggested that the remanufacturing requirements should apply to small railroads because they provide significant freight service to the six New England states, but that action would be short-sighted. ASLRRA stated that it believes that exemption is the right course not only for the health of the class II and class III railroads that now provide the only rail service to that region, but also because doing otherwise would not have the intended effect of reducing emissions.

ASLRRA noted that a recent history of railroad service in New England shows that, decades ago, class I railroads provided the freight rail service now offered by smaller class II and class III carriers. Over time, the lack of significant traffic resulted in abandonments of many lines, and other marginal lines were spun off as independent small railroads whose lower costs could sustain operations with light density traffic. This has resulted in these lower-cost carriers providing the only service to five of the six New England states. These carriers operate on extremely thin margins (compared to their class I predecessors they are often undercapitalized and lack access to the lower cost public financial markets); and they purchase older, second hand equipment because that is the only equipment they can afford to buy. ASLRRA stated that freight traffic in much of New England continues to wane, and that requiring costly retrofitting of the equipment small railroads operate will "plunge many barely viable lines into the red", and those lines will be quickly abandoned. Freight rail service will disappear just as it has in the past when market conditions could not sustain it. Consequently, increased movement of freight by truck resulting from the decline of small railroads will exacerbate, not decrease, emissions in the region.

Also, ASLRRA commented that it does not agree with the imposition of a burdensome rule on small railroad businesses nationally to address the concerns of a single region. It is best to resolve local issues locally, and stated that a workable model exists to do so. California has adopted the Carl Moyer Grant Program to provide funds for small railroads to retrofit their locomotives to meet the stringent emission standards that California desires.

Rail World, Inc. expressed that it believes that the term "existing fleet" could be subject to interpretation—in the extreme, the term could be applied in a manner that only those locomotives in the existing fleet of a small railroad at the time of the implementation of the rule are exempt. As such, any future purchases of used locomotives by a small railroad could be subject to the proposed rules. Thus, to insure that the rule is clear and unambiguous, it should be stated in the rule that the term "existing fleet" as it applies to the exemption for small railroads is defined in part as being any and all locomotives built after 1972 and in existence at the time the rule is made effective, regardless of the ownership on that date. This will allow for the used units to be economically purchased and placed into service by small railroads.

<u>Letters:</u>
American Short Line and Regional Railroad Association (ASLRRA) OAR-2003-0190-0560.1
Environmental Defense, et al. OAR-2003-0190-0592.1
New Jersey Department of Environmental Protection, Air Quality Management (NJDEP)

OAR 2003-0190-0562.2
New York State Department of Environmental Conservation, OAR-2003-0190-0583.1
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0551.1
Ozone Transport Commission (OTC)OAR-2003-0190-0633.1
Puget Sound Clean Air Agency OAR-2003-0190-0484 (hearing)
Rail World, Inc. OAR-2003-0190-0474

Our Response:

As described in section IV.A.(13) of the rulemaking (*Small Business Provisions*), we are limiting the category of small railroads which are exempt from the Tiers 0, 1 and 2 remanufacturing requirements for existing fleets to those railroads that qualify as Class III railroads and that are not owned by a large parent company. Under the current Surface Transportation Board classification system, this exemption is limited to railroads having total revenue less than $25.5 million per year. This change requires that all Class II railroads, when remanufacturing their locomotives, meet the new standards finalized for existing fleets.

We believe that continuing to exempt Class III railroads with annual revenues under $25.5 million while including all Class II railroads (Class II railroads have from $25.5 million to $319.3 million in yearly revenues) in the existing fleet program is a reasonable approach that addresses both industry concerns regarding costs while also recognizing that small railroads do contribute to air pollution in areas they service including nonattainment areas throughout the U.S. Most but not all Class II and III freight railroads qualify as small businesses, and the majority of freight rail in some regions of the country is Class II and III. Thus, exempting Class II railroads that qualify as small businesses would lead to limited emission benefits for these regions.

In regard to the comments on intercity passenger or commuter railroads, we are clarifying our definition that these railroads are not included as railroads that are small businesses because they are typically governmental or are large businesses. Due to the nature of their business, these entities are largely funded through tax transfers and other subsidies. Thus, the only passenger railroads that could qualify for the small railroad provisions will be small passenger railroads related to tourism.

In response to Rail World, Inc.'s specific comments on rejecting the $25.5 million per year revenue threshold, we believe that this annual revenue limit is the most appropriate criteria to determine which small railroads are exempt from the remanufacturing requirements for existing fleets. As stated above, it exempts fewer railroads and reduces emissions in nonattainment areas in the nation while addressing industry's cost concerns – as compared to the thresholds of 1,500 employees for line-haul railroads and 500 employees for short-haul railroads (which are the same definitions as those used by SBA) or the $250 million annual revenue criteria cited by the commenter. In addition, annual revenue is a more appropriate criteria compared to either earnings or return on investment (ROI), which were mentioned by the commenter, since data on these latter two items is limited, especially for small businesses. Using earnings or ROI as a threshold would require us to estimate these items where there are currently insufficient data. Thus, the $25.5 million annual revenue threshold is the preferred criteria.

For Rail World, Inc.'s comment on clarifying the term "existing fleet," it is important to note that within the definition of "new" in §1033.901 (*Definitions*) of the regulations -- paragraph (2)(ii), it specifies that "Locomotives that are owned or operated by a small railroad and that have never been remanufactured in a certified configuration are not considered to become new when remanufactured." Thus, if a small railroad's (Class III railroads that are not owned by a large parent company) locomotive has not been previously remanufactured into a certified configuration or certified to EPA emission standards, it would be exempt from the remanufacturing requirements. However, if its locomotive was previously remanufactured into a certified configuration, it must comply with the requirements. Refer also to §1033.610 (*Small railroad provisions)* of the regulations. In addition, paragraph (2)(i) of the definition of new states that "Locomotives and engines that were originally manufactured before January 1, 1973 are not considered to become new when remanufactured unless they have been upgraded …." Thus, for the purpose of the locomotive requirements, an existing fleet locomotive is indeed considered to be any and all locomotives built after 1972 and in the fleet when the regulations become effective, irrespective of ownership.

7.2 Exemptions for Small Locomotive Remanufacturers

What Commenters Said:

General Electric Transportation (GE) noted that the proposed rule included an exemption for small remanufacturers from production line and in-use testing until 2013 (72 FR 15995). EPA's rationale that the small businesses in the locomotive remanufacturing and railroad industry do not tend to have the financial resources or technical expertise to quickly respond to the requirements contained in the proposed rule is flawed. The commenter noted that, while it may have been true that it would be an unreasonable burden on small remanufacturers to meet testing requirements when the locomotive standards were first issued in 1998, the industry and availability of test facilities have advanced significantly since that time. The exemption is no longer justified and small remanufacturers should not be excused from testing requirements.

GE noted that in the early years of this program, EPA is requiring Tier 0 locomotives to meet Tier 1 standards and Tier 1 locomotives to meet Tier 2 standards; thus, the test facilities for Tier 1 and 2 emissions standards should already be in place, so a delay in test requirements could only serve to place at risk the compliance of locomotives being introduced into commerce. To ensure the integrity of the program, EPA should impose the same testing requirements on all remanufacturers - large and small. The commenter also noted that the proposed rule pointed out that the phase-in of test requirements also applied for small remanufacturers in the original locomotive emission regulations under part 92. At the time those rules were issued, even the OEMs had not developed their own test equipment, so it was understandable that smaller businesses might have difficulty obtaining test time at Southwest Research Institute or another, new test location. Today, there are numerous test facilities across the country. GE also commented that it has its own facilities, and those facilities could be contracted to small businesses for testing—GE believes that the costs are no longer prohibitive and do not present a barrier to market entry. GE urges EPA to, given the increased availability of testing, strike the balance in favor of emissions reductions to ensure the promised rule benefits.

In its comments, MotivePower, Inc. requested that the proposed definition of "small manufacturer" (§1033.901) be changed to exclude the parent company and that the basis be changed to annual sales less than $500 million. In all of Part 1033, this definition is germane only under §1033.150(a)(4)(d) -- Small manufacturer/remanufacturer provisions within *Interim provisions* section of regulations, which delays production-line and in-use testing requirements until January 1, 2013 for small manufacturers. The commenter believes that in this context, the amount of locomotive work performed is most relevant in determining whether a delay in meeting testing requirements is warranted, and therefore, the annual sales of the manufacturer, excluding the parent company data in determining the status of small manufacturer.

The Puget Sound Clean Air Agency suggested that anti-idle technology (automatic engine stop/start (AESS)) be required for remanufactured existing locomotives even if they are owned by small businesses.

The New York State Department of Environmental Conservation commented that it agrees with EPA's decision to limit the railroad in-use testing program to Class I railroads.

The Association of American Railroads (AAR) expressed that it is possible that there will not be a remanufacturing system available for all of the older engine families. For example, the railroads questioned whether there will be a remanufacturing system for the over 2,000 EMD SD-2 locomotives in service on Class I railroads. The proposed §1033.6l0 (*Small railroad provisions*) of the regulations authorizes EPA to exempt locomotives owned by small railroads from the obligation to remanufacture locomotives to EPA standards if there is no remanufacturing system available for the locomotives. AAR commented that it believes there is no reason to exempt only small railroads in such an instance. The commenter further stated that it believes that all railroads should be entitled to an exemption if there is no remanufacturing system available.

<u>Letters:</u>
Association of American Railroads (AAR) OAR-2003-0190-0566.1
General Electric Transportation (GE) OAR-2003-0190-0590.1
MotivePower, Inc OAR-2003-0190-0613
New Jersey Department of Environmental Protection, Air Quality Management (NJDEP) OAR-2003-0190-0562.2

New York State Department of Environmental Conservation, OAR-2003-0190-0583.1
Puget Sound Clean Air Agency OAR-2003-0190-0484 (hearing)

Our Response:

In regard to the GE comments on not exempting small remanufacturers from production line and in-use testing until 2013, we continue to believe it is important to provide flexibility to these small entities to minimize the burden on small businesses that need added flexibility to meet the standards, while ensuring the greatest emissions reduction achievable. Although this rule will not have a significant impact on a substantial number of small entities (refer to section IX.C – *Regulatory Flexibility Act* – of the rulemaking), we will try to reduce the impact of this rule on such entities. We understand that there may be increased availability of test facilities, but as we stated in the proposed rule (72 FR 15938, April 3, 2007), some small remanufacturers still may not have the financial resources or technical expertise to quickly respond to the new requirements. In addition, we are finalizing the amendment to this provision that small remanufacturers are no longer exempt from in-use testing for the entire useful life of a locomotive or a locomotive engine. By providing additional time to comply with this amendment, the burden for small remanufacturers would likely be reduced. As described in section IV.A.(13) of the rulemaking (*Small Business Provisions*), this amendment ensures that small remanufacturers comply with the standards in-use, and subsequently, the public is assured of receiving the air quality benefits of this rule. Finally, we believe that this 5-year delay will not provide any significant competitive advantage to small remanufacturers, and thus it should not have a significant adverse impact on the larger business entities.

In response to the MotivePower, Inc. comment that the proposed definition of "small manufacturer" be changed to exclude the parent company and that the basis be changed to annual sales less than $500 million, we refer back to the intent of the flexibility provisions for small entities as described above and in the proposed rule. Small entities in the locomotive remanufacturing and railroad industry tend not to have the financial resources or technical expertise to quickly respond to the requirements contained in the rule. Therefore, the flexibility provisions are designed to minimize regulatory burdens on small businesses needing added flexibility to comply these requirements, while still while ensuring the greatest emissions reductions achievable. Extending the same flexibilities to entities affiliated with large parent companies would be providing relief to those entities that do indeed typically have the financial resources and technical expertise to respond quickly to the new emission standards, which is contrary to the intent of flexibility provisions for small entities. Moreover, we need to ensure emissions decrease based on the new regulations, and expanding flexibility provisions to large entities (and more companies) will likely hinder this objective. Therefore, we will include the employees from the parent company in the determining whether an entity qualifies as a small manufacturer.

As for revising the small business threshold to $500 million in annual sales for small manufacturer or remanufacturer, it is essential to realize that the 1,000 employee threshold is based on the small business definition provided by the Small Business Administration's (SBA) regulations at 13 CFR 121.201 (according to the NAICS codes 333618, *Other Engine Equipment Manufacturing,* and 336510, *Railroad Rolling Stock Manufacturing,* for manufacturers and remanufacturers of locomotive engines). Section 601 of the Regulatory Flexibility Act (RFA) permits you to establish an alternative definition of small for the entities subject to a rule when the definition is "appropriate to the activities of the agency." In general, a situation such as SBA's size standards not being most appropriate for considering impacts on small entities is when we can consider establishing an alternative definition. However, we believe there has not been sufficient information provided by the commenter to show that SBA's 1,000 employee threshold is not the most appropriate criteria – and that the $500 million in annual sales would be more fitting. Also, setting an alternative definition for small entities requires notice and opportunity for public comment, and as stated earlier, we do not believe enough new information has been brought forward to demonstrate a need for an alternative definition and/or notice and comment on such an alternative. In addition, including the parent company (as we responded earlier) more aligns with a 1,000 employee limit. Thus, we believe that the 1,000 employee criterion is still the best indicator of what is a small versus large manufacturer (or small versus large business).

In response to the comment from Puget Sound Clean Air Agency on requiring anti-idle technology - AESS - for small entities' remanufactured existing locomotives, it is important to note that, as described in section III.B.1(c) of the rulemaking (*Reduction of Locomotive Idling Emissions*), it is widely accepted that for most locomotives, the fuel savings that result in the first few years after installation of an AESS system will more than offset the cost of adding the system to the locomotive. Given these short payback times for adding idle reduction technologies to a typical locomotive, normal market forces have led several small railroads -- as well as many large railroads -- to retrofit a number of their locomotives with these technologies. However, some railroads have determined that the fuel savings is not enough to justify the cost of the retrofit. Thus, we are requiring that at least an AESS be used on all new Tier 3 and Tier 4 locomotives, and also installed on all existing locomotives that are subject to the new remanufactured engine standards, at the point of first remanufacture under the new standards. As described earlier, only small railroads -- Class III railroads that are not owned by a large parent company -- are now exempt from the remanufacturing requirements (unless their locomotives were previously certified to EPA emission standards). Thus, this AESS provision will only apply to Class I and II railroads -- not most Class III railroads (nearly all Class III railroads are small businesses). Even though many Class II railroads are small businesses, these entities will now need to adhere to this AESS provision. This is a reasonable step to address the above comment on small entities. In addition, for Class I and II railroads, we expect there to be significant emission reductions, as well as longer term fuel savings, from applying AESS. However, for Class III railroads, we project that there would be relatively small emission reductions (and longer term fuel savings) from this provision in comparison to the Class I and II railroads.

Ultimately, we have decided to exempt only small railroads (or Class III railroads as discussed above) from the remanufacturing requirements, and thus, we will not require idle reduction technologies for small or Class III railroads. Market forces will likely lead to more Class III railroads utilizing these technologies in the future, and we do not want to create a burden for these entities for a relatively small emission reduction. Also, we are committed to minimizing the economic impact of the regulations on small business entities.

In regard to the AAR comments that all railroads (not only small railroads) should be entitled to an exemption from remanufacturing requirements if there is no remanufacturing system available, we have decided to continue to only provide this exemption for small railroads. For small railroads, potentially no remanufacturer will certify a system for very old locomotive models that make up a small fraction of the fleet and are remanufactured infrequently. Such a situation is high unlikely for a large railroad, who will likely have a much different fleet make up.

7.3 Exemptions for Marine Small Volume Manufacturers

What Commenters Said:

NESCAUM commented that it concurs with EPA's position that the five-year compliance delay for small-volume manufacturers of recreational marine diesel engines, as provided in current regulations, is unnecessary for the purpose of meeting the Tier 3 standards. The commenter however noted that, because it is taking the position that smaller marine engines should be subject to the Tier 4 standards, it does recognize that it may be appropriate to allow small-volume manufacturers some additional time to meet the Tier 4 standards.

Letters:
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0551.1

Our Response:

We are not finalizing Tier 4 standards for recreational marine engines at this time. However, for the Tier 3 standards that we are adopting for these engines, we will not provide the five-year delay for complying with the standards. As discussed in section IV.A.13.b(iii) of the rulemaking (*Small Business Provisions*), the Tier 3 standards for recreational marine engines are expected to be engine-out standards which do not require the use of aftertreatment – similar to the existing Tier 1 and Tier 2 standards. Also, Tier 3 engines are expected to require far less in terms of new hardware, and in fact, are expected to only require upgrades to existing hardware (i.e., new fuel systems). In addition, manufacturers have experience with engine-out standards from the existing Tier 1 and Tier 2 standards, and thus, they have learned how to comply with such standards. Thus, small-volume manufacturers of recreational marine diesel engines do not need more time to meet the new standards. For small post-manufacture marinizers of recreational marine diesel engines, the one-year delay described in the rule will provide enough time for these entities to meet the new standards.

7.4 Other

What Commenters Said:

National Maintenance & Repair, Inc. commented that it believes that original equipment manufacturers (OEMs) have a built-in advantage, and the regulations as proposed would only add to this advantage. Many small companies will be adversely affected by the regulations, possibly to the point of bankruptcy; and the commenter urged that EPA take small business concerns into consideration.

Chromium Corporation expressed that it believes the proposed certification and kit concept strongly favors a monopoly of repair and replacement parts by the OEMs. The fresh or remanufactured engine certificate requires that at all components essential to meeting emission requirements are included in the kit. These types of certificates are extraordinarily expensive to develop and test, which puts the certificates out of reach for most small companies.

Kaydon commented that with the 2007 proposed standards to reduce both NOx and PM, it believes the OEMs are again in the process of establishing that every component in a power assembly, turbocharger, and air-cooling equipment is a 'critical component' regardless of its impact on the combustion process or oil consumption. (The commenter noted that following as examples of non-critical components: bolts, gaskets, valve springs, rocker arm bearings, piston pins, piston rods, etc.) OEMs are again trying to dominate the proceedings and eliminate the small businesses from market participation. Kaydon stated that it believes the result of permitting every component to be classified as 'critical' is a repeat of the same problems experienced with the original locomotive emissions implementation in 2002. This will eliminate many small business manufacturers from the marketplace, and will seriously damage local economies around the country and promote an engine parts monopoly for the locomotive OEMs.

Coalition of Aftermarket Rail and Marine Engine Suppliers (CARMES) -- particularly the CARMES company or member UNIPAR, Inc. -- commented that they believe the proposal floated by locomotive OEMs is to eliminate Tier 0 regulations adopted in 2000 and to mandate that these locomotives now comply with Tier 1 or 2 regulations. The OEMs have stated that they can comply with this proposal and that they have the technology. In 1999 the locomotive aftermarket met with the EPA, FRA, and others to express their concerns, which are basically the same today. Some of these concerns are listed below:

- What benefit is there for small business? This will put many people and companies out of business, and the OEMs know this.
- EPA should realize this for what it is and stop this attempt to hurt small business. If

the OEMs can't win in the marketplace by providing the quality product and service demanded for by the end user, they should quit trying to have the government do it for them by legislating meaningless propositions.

Letters:
Chromium Corporation OAR-2003-0190-0651
Coalition of Aftermarket Rail and Marine Engine Suppliers (CARMES) OAR-2003-0190-0650
Kaydon Ring & Seal, Inc. (Kaydon) OAR-2003-0190-0654
National Maintenance & Repair, Inc. OAR-2003-0190-0655

Our Response:

Refer to section 4.10.3 - *Non OEM Remanufacturing and Part Suppliers* - of this Summary and Analysis of Comments document for a response to the above comments on the effect this rule would have on OEMs in comparison to aftermarket suppliers. However, for the comments pertaining to the impact of the rulemaking on small entities, it is important to note that we have taken steps to identify the regulatory burden of the rule on small businesses and to involve them in the regulatory process. Toward this end, EPA requested comment on several provisions designed to ease the regulatory burden on small locomotive entities. In the final rule, EPA has attempted address these comments and to minimize the economic burden of compliance on small business entities wherever possible. As described below, we are providing flexibilities to small locomotive entities, and for a complete description of the flexibilities in the final rule, refer to section IV.A.(13) - *Small Business Provisions* – of the preamble to the final rule.

- Small locomotive remanufacturers are granted a waiver from production-line and-in-use testing for up to five calendar years after this program becomes effective.

- Class III railroads qualifying as small businesses are exempt from new Tier 0, 1, and 2 remanufacturing requirements for locomotives in their existing fleets.

- Railroads qualifying as small businesses continue being exempt from the in-use testing program.

- Locomotive entities, including those that are small businesses, have hardship relief provisions -- i.e., apply for additional time.

Even with these flexibilities, small locomotive remanufacturers will still need to ensure that they are not increasing emissions, and thus, they must comply with some of the new program requirements. However, by finalizing the above flexibility options as well as the compliance provisions discussed in Chapter 4 of this Summary and Analysis of Comments document, we have taken into account the concerns expressed by aftermarket suppliers for our regulatory approach. In addition, as described earlier, the final rule will not have significant adverse impacts on a substantial number of small entities.

8. ADMINISTRATIVE REQUIREMENTS & LEGAL AUTHORITY 8-1
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8. ADMINISTRATIVE REQUIREMENTS & LEGAL AUTHORITY

What We Proposed:

The comments in this chapter are centered on the administrative and procedural requirements and legal authority related to the proposed rule. 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 docket for this rulemaking (EPA-HQ-OAR-2003-0190).

8.1 Clean Air Act and Statutory Authority

8.1.1 General

What Commenters Said:

The California Air Resources Board (CARB) commented that it believes that the CAA requires EPA to establish stringent, aftertreatment-based emission standards, and encourages EPA to set and implement such standards as soon as feasible.

Letters:

California Air Resources Board (CARB)	OAR-2003-0190-0596.1

Our Response:

As noted in the preamble to the proposed rule, EPA does in fact have authority under the Clean Air Act to set emissions standards for the engines and vehicles being regulated by this rulemaking. We refer the reader to section I.B(3) of the preamble to the final rule for a more detailed discussion on EPA's authority under the Clean Air Act for the locomotive and marine program.

8.1.2 Energy Security

What Commenters Said:

General Electric Transportation (GE) commented that, while it believes that the standards may be technologically achievable in the time frame allowed, it does not believe that the proposal took into account the significant fuel efficiency penalty associated with bringing these units to a Tier 1 level standard. Thus, the commenter stated, the new Tier 0 standard will clearly impact other pollutants and have a negative energy impact. The commenter noted that Clean Air Act (CAA) section 213(a)(5) (42 U.S.C. §7547(a)(5)), which EPA cited as the authority for this rule, requires any standards applicable to locomotives to be based on achievability, giving appropriate consideration to cost, noise, energy, and safety. The commenter stated that it does not believe that EPA either looked at the effects of the Tier 1 standards for NOx on other emissions or took the energy impact into account. The commenter urged EPA to consider these effects in establishing the final rule and provide a reasonable estimate of the cost of achieving them.

Letters:
General Electric Transportation (GE)OAR-2003-0190-0590.1

Our Response:

Executive Order (E.O.) 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use" (66 FR 28355 (May 22, 2001)), requires EPA to assess the energy effects for any action identified as a "significant energy action." This rule's potential effects on energy supply, distribution, or use have been analyzed and are discussed in detail in section 5.8 of the Final Regulatory Impact Analysis (RIA). As stated in that section, while we project that this rule would result in an energy effect that exceeds the 4,000 barrel per day threshold noted in E.O. 13211 in or around the year 2022 and thereafter, the program consists of performance-based standards with averaging, banking, and trading provisions that make it likely that our estimated impact is overstated. Further, the fuel consumption estimates upon which we are basing this energy effect analysis, which are discussed in full in sections 5.4 and 5.5 of the RIA, do not reflect the potential fuel savings associated with automatic engine stop/start (AESS) systems or other idle reduction technologies. Such technologies can provide significant fuel savings which could offset our projected estimates of increased fuel consumption. Nonetheless, our projections show that this rule could result in energy usage exceeding the 4,000 barrel per day threshold noted in E.O. 13211.

8.1.3 Achievability/Feasibility of Standards and Lead-time

What Commenters Said:

GE noted that, under CAA section 213(a)(5), EPA is required to set locomotive emissions standards based on technologies that the Administrator determines will be available at the time that compliance is required for such emissions standards. GE further commented that, assuming section 213(a)(5) applies and using its standard, it does not believe that EPA has established that the aftertreatment technologies will be available in 2017 as proposed. The commenter stated that it has significant issues regarding the ability of aftertreatment to reliably achieve the 1.3 gram per brake horsepower-hour (g/bhp-hr) Tier 4 NOx emission level over the useful life of the locomotive (see OAR-2003-0190-0590.1, Appendix A). The commenter stated that it does not believe that the proposed rule and supporting documents address these concerns. The commenter noted that under FMC, Corp. V. Train, 539 F.2d 973 (4th Cir. 1976), even where standards are intended to be technology forcing (in that case, with compliance dates 9 years in the future), EPA cannot rely on conclusory statements regarding the ability to achieve a standard.

(Id. At 981.) GE commented that, applying those principles here, EPA would need to explain why the recent studies—and the only ones using real engine exhaust and the catalyst applicable to locomotive operations—should be rejected in light of older studies conducted in laboratory environments with simulated exhaust.

GE also cited Tanners' Council of Am., Inc. V. Train, 540 F.2d 1188, 1191 (4th Cir. 1976), in which the Court noted that EPA's 1983 standards were based on conjectural developments expected, but stated that EPA's action was only justified because the standards were required to be set within one year of enactment - a time period that did not allow for extensive testing - and the standards would be reviewed and revised as appropriate on an annual basis. GE commented that EPA faces no such deadline for issuing the locomotive and marine standards. The commenter further noted that the Court emphasized that if EPA intends to require control technologies that have not been applied, the record must demonstrate "that there is a reasonable basis to believe that the technology will be available by [the compliance date]." (Id. At 1195. See, also, NRDC v. EPA, 822 F.2d 104, 115, n.12 (D.C. Cir. 1987).) GE commented that, as EPA determines if a technology will be available in the future to meet a particular environmental standard, EPA is required to do more than present the conclusory statements presented in the preamble to the proposed rule and the Draft RIA. The commenter stated that this is particularly true where commenters have pointed to published papers and other information indicating that the standards will not be able to be achieved throughout the period during which they apply. The commenter noted that while EPA can rely on technologies that are not yet being utilized in practice, there must be a reasoned basis for believing that the technologies will be available and that they will achieve the required levels; and the commenter stated that it believes this reasoned basis is lacking here.

GE commented that it believes that EPA has not met the burden to demonstrate that the locomotive emission standards will be achievable in the timeframe provided, taking into account cost, energy, noise, and safety factors as provided under CAA section 213. The commenter stated that it hopes to be able to work with EPA to reach a common understanding of the data and to consider the options for taking the most recent data into account in establishing the final Tier 4 NOx standard.

Letters:
General Electric Transportation (GE)OAR-2003-0190-0590.1

Our Response:

CAA section 213(a)(5) directs EPA to adopt emission standards for new locomotives and new engines used in locomotives that achieve the "greatest degree of emissions reductions achievable through the use of technology that the Administrator determines will be available for such vehicles and engines, taking into account the cost of applying such technology within the available time period, the noise, energy, and safety factors associated with the applications of such technology." As discussed further in chapter 10 of this Summary and Analysis of Comments document, section III of the preamble, and Chapter 4 of the Final RIA, EPA has evaluated in detail the available information, including our own testing, to determine the technology that will be available for locomotives and engines subject to EPA standards, and we have determined that the standards are feasible in the lead time provided.

8.1.4 State Pre-emption and Regional Programs

What Commenters Said:

The National Association of Clean Air Agencies (NACAA) noted that with section 101(a)(3) of the Clean Air Act, Congress vested state and local clean air agencies with "primary responsibility" for the control of air pollution. The commenter noted that this is a responsibility that it takes very seriously. NACAA commented that, as it seeks to achieve and sustain clean, healthful air throughout the country, it must consider the full measure of emission reductions feasible from every source of pollution as quickly as possible. The commenter noted that with respect to locomotive and new marine diesel engine emissions, however, states and localities are preempted from taking regulatory action.

The South Coast Air Quality Management District (SCAQMD) suggested that EPA adopt a regional rule for locomotives used in the South Coast (and other areas that are in need of early reductions). The commenter stated that this would accomplish the dual goals of demonstrating the advanced technology and providing needed assistance in meeting PM2.5 standards by 2014 and reducing local exposure to locomotive emissions. The commenter stated that it believes that there is nothing in the Clean Air Act prohibiting EPA from adopting a regional rule—that the Clean Air Act merely requires EPA to adopt standards for new locomotives. The commenter cited that when a statute does not specify the mode of exercising a particular power, any reasonable mode may be selected (San Diego Gas & Electric Co. V. San Diego County Air Pollution Control District, 203 Cal. App. 3d 1132, 1144); and further, the determination that EPA is empowered to adopt regional rules would be entitled to deference from the courts (Chevron U.S.A. Inc. V. Natural Resources Defense Council, 467 U.S. 837 (1984)). The commenter stated that it believes EPA is clearly empowered to adopt a rule requiring early phase-in of Tier 4 engines; and if such early phase-in is possible, EPA is obligated to require it, under the provisions of the CAA requiring standards to "take effect at the earliest possible date" (CAA section 213(b)). SCAQMD commented that it believes EPA could even adopt requirements that railroads operating in such areas purchase the Tier 4 locomotives when adding to or replacing locomotives in their fleet; and noted that, as held by the U.S. Supreme Court, "standards" refer to the emission characteristics of engines, and can be enforced either against manufacturers or purchasers (Engine Mfrs. Ass'n. V. South Coast Air Quality Management District, 541 U.S. 246, 253 (2004)). The commenter stated that it believes that once railroads operating in heavily polluted areas are required to purchase Tier 4 locomotives, they can begin routing such cleaner locomotives to the areas that need them the most, to the extent feasible. Lastly, the commenter noted that there is precedent for the railroads voluntarily agreeing to route the cleanest locomotives into the South Coast region, under an agreement with the California Air Resources Board.

<u>Letters:</u>

National Association of Clean Air Agencies (NACAA) OAR-2003-0190-0495
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0483

Our Response:

State and local governments continue working to protect the health of their citizens and comply with requirements of the CAA, as part of this effort they recognize the need to secure additional major reductions in both diesel $PM_{2.5}$ and NOx emissions by undertaking numerous state-level actions. Congress has preempted states from regulating new locomotive and marine engines, and EPA has therefore attempted to put in place a program that achieves emission reductions as quickly as feasible from these engines. This final program results in earlier and significantly greater NOx and PM reductions from the locomotive and marine sector than the proposed program because of the standards for remanufactured marine engines and the two-year pull-ahead of the Tier 4 NOx requirements for line-haul locomotives and for 2000-3700 kW (2760-4900 hp) marine engines. These changes reflect important efforts by all parties to implement cleaner technology as early as possible.

Regarding the discussion of a regional program, CAA section 213(a)(5) requires technology-based standards to be put in place at the earliest date feasible. EPA standards achieve this requirement for locomotives throughout the United States, and EPA does not believe a mandatory regional program, even if could be reconciled with the language of the statute, could achieve reductions in an appreciably faster time frame, particularly given the fact that individual locomotives by their nature travel widely throughout the country. While this final program will help many states and communities achieve cleaner air, for some areas, such as the South Coast of California, the reductions achieved through this rule will not alone enable them to meet their near term ozone and PM air quality goals. (This was also the case for our 1998 locomotive rulemaking, where the State of California worked with Class I railroads operating in southern California to develop a Memoranda of Understanding (MOU) ensuring that the cleanest technologies enabled by federal rules was expeditiously introduced in areas of California with greatest air quality improvement needs.) We continue to support California's efforts to reconcile likely future growth in the locomotive and marine sector with the public health protection needs of the area, and the final rule includes provisions which are well-suited to encouraging early deployment of cleaner technologies through the development of similar programs.

Additionally, EPA has a number of voluntary programs in place that help enable government, industry, and local communities to address challenging air quality problems. The EPA SmartWay program has initiatives to reduce unnecessary locomotive idling and to encourage the use of idle reduction technologies that can substantially reduce locomotive emission while reducing fuel consumption. EPA's National Clean Diesel Campaign—through the Clean Ports USA program—is working with port authorities, terminal operators, and trucking and rail companies to promote cleaner diesel technologies and emission reduction strategies through education, incentives, and financial assistance. Part of these efforts involves voluntary retrofit programs that can further reduce emissions form the existing fleet of diesel engines. Finally, EPA is implementing a new Sustainable Ports Strategy which will allow EPA to partner with ports, business partners, communities and other stakeholders to become world leaders in sustainability including achieving cleaner air. This new strategy builds on the success of collaborative work EPA has been doing in partnership with the American Association of Port Authorities (AAPA), and through port related efforts of Clean Ports USA, SmartWay, EPA's Regional Diesel Collaboratives and other programs. Together, these approaches augment the locomotive and marine program and they help states and communities achieve larger reductions sooner in the areas of our country that need them the most.

8.1.5 Regulation of "New" Engines

What Commenters Said:

Clean Air Task Force (CATF) commented that it urges EPA to continue to treat remanufactured engines as new engines, and to require them to meet emissions standards reflecting best available control technology, as required by section 213 (a)(5) of the Clean Air Act. Similarly, Environmental Defense, NRDC, et al. (0592.1) commented that the Clean Air Act requires EPA to apply technology-forcing emission standards to remanufactured locomotive engines, because section 213(a)(5) states that EPA must "promulgate regulations containing standards applicable to emissions from new locomotives and new engines used in locomotives," and EPA has defined "new locomotive engine" to include an engine which has been remanufactured. The commenters noted that EPA is likewise required to apply technology-forcing emission standards to remanufactured marine diesel engines, as section 213(a)(3) directs EPA to "promulgate (and from time to time revise) regulations containing standards applicable to emissions from those classes or categories of new nonroad engines and new nonroad vehicles (other than locomotives or engines used in locomotives) which in the Administrator's judgment cause, or contribute to," air pollution. The commenters stated that Congress took a comprehensive approach in delegating rulemaking responsibility to EPA, calling for the establishment of emission standard that apply to new vehicles and engines, and included language to ensure that remanufactured engines—engines that are functionally new—cannot elude protective emission standards. The commenters noted that such an approach follows inextricably from the statutory text and is essential to carry out the core statutory purpose of section 213—to address emissions from new engines, based on the natural and ordinary understanding of that term, that endanger public health and welfare—and stated that they believe that taking a different approach would be arbitrary and capricious, an abuse of discretion, and contrary to law. The commenters further stated that "a narrow definition of new locomotive engines, limited to freshly manufactured engines, would effectively undercut the ability of the Agency to reduce emissions contribution from this segment of the nonroad inventory."

Letters:
Clean Air Task Force OAR-2003-0190-0499
Environmental Defense, NRDC, et al. OAR-2003-0190-0592.1

Our Response:

The emission standards for new locomotives and new locomotive engines were set pursuant to the authority under CAA section 213(a)(5). We previously determined that certain existing locomotive engines, when they are remanufactured, are returned to as-new condition and are expected to have the same performance, durability, and reliability as freshly-manufactured locomotive engines. Consequently we set emission standards for these remanufactured engines that apply at the time of remanufacture (defined as "to replace, or inspect and qualify, each and every power assembly of a locomotive or locomotive engine, whether during a single maintenance event or cumulatively within a five-year period…" (see 61 FR 53102, October 4, 1996; 40 CFR 92.2). This rulemaking adopts new tiers of standards for both freshly manufactured and remanufactured locomotives and locomotive engines.

See section 9.5 of this Summary and Analysis of Comments document for comments (and associated responses) concerning EPA's legal authority to set standards for remanufactured marine diesel engines.

Regarding the definition in section 216(3), that is the definition of "new motor vehicle." While EPA has generally followed that definition for determining "new" in the context of nonroad engines and nonroad vehicles, and believes it generally to be an appropriate guide, EPA has made clear in the past, with regard to locomotives, and now, with regard to larger marine diesel engines, that the remanufacturing process for such engines, which stay in service much longer than typical motor vehicle engines, is so thorough as to return the engine to as-new condition, and thus should make the engine subject to section 213. Please see section I.B.(3) of the preamble to the final rule for a more detailed discussion regarding our rationale for treating "remanufactured" marine engines as "new" engines.

8.1.6 Lead-time and Stringency of the Standards

What Commenters Said:

EMA commented that the CAA expressly recognizes the fundamental importance of regulatory lead-time. The commenter particularly noted that section 202(a)(3)(C) mandates a 4-year lead-time period for any emission standards applicable to heavy-duty vehicles or engines (42 U.S.C. §7521(a)(3)(C)). The commenter also noted that section 213(b), the statutory section pertaining to the types of nonroad emission standards at issue in this rulemaking, mandates that the effective date for any such standards must be set "considering the lead-time necessary to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance within such period, and energy and safety." (42 U.S.C. § 7547(b)) EMA commented that, in light of these controlling provisions of law, it typically seeks a minimum of 4-years' lead-time for any new engine emission standards that EPA seeks to implement. The commenter further stated that the CAA also requires a sufficient period of regulatory stability (the period of time between each new level or "Tier" of emission standards that becomes applicable to a given type of engine). EMA commented that, with respect to heavy-duty on-highway (HDOH) engines, section 202(a)(3)(C) mandates a 3-year stability period (42 U.S.C. §7521 (a)(3)(C)); thus, the commenter typically seeks a minimum 3-year stability period for any new engine emission standards promulgated by EPA.

EMA commented that, depending on the timing of the finalization of this rulemaking, it is concerned that the effective date could provide less than one year of lead-time for smaller marine engines, which typically would amount to a violation of the CAA's lead-time requirement. The commenter additionally stated that, for commercial marine engines rated between 1400-3700 kW, the proposed Tier 4 standards could follow the implementation of the proposed Tier 3 standards by less than three years, which it believes would typically amount to a violation of the CAA's stability requirement.

Environmental Defense, NRDC, et al. noted that section 213 of the Clean Air Act governs EPA's exercise of its delegated rulemaking responsibility to address emissions from nonroad engines and nonroad vehicles. The commenters noted that CAA sections 213(a)(3) and 213(a)(5) mandate that EPA has a legal duty to establish emission standards that "shall achieve the greatest degree of emission reduction achievable" considering relevant statutory factors. The commenters stated that this legal standard is further illuminated by the statutory mandate for EPA to "first consider standards equivalent in stringency to standards for comparable motor vehicles or engines." (CAA section 213(a)(3)) The commenters further noted that section 213(b) pointedly addresses - and constrains - the phase-in of emission standards under section 213 by instructing EPA to establish standards that "shall take effect at the earliest possible date" considering various statutory factors. The commenters stated that the statute thus establishes a comprehensive protective bar for evaluating EPA's promulgation of rules for these engines and vehicles by mandating standards that secure the greatest degree of emission reduction achievable at the earliest possible date considering first the stringency of standards for onroad vehicles and engines. The commenters also commented that they believe the text firmly and inescapably embodies Congress' mandate for swift, protective EPA action. The commenters thus stated that they believe that any delay in implementing the proposed standards or in adopting standards that do not reflect the greatest degree of emission reduction achievable would be contrary to law by running afoul of EPA's delegated regulatory responsibilities under the Clean Air Act.

Environmental Defense, NRDC, et al. commented that, to satisfy EPA's legal responsibilities the technologies and whether or not the resulting standards are "equivalent in stringency" to those adopted for highway engines and vehicles. The commenters stated that there is no question that the proposed emission standards and implementation timetable are in fact considering relevant statutory factors, as shown by the comments of the emissions control and engine manufacturers (the commenters cited statements by MECA and EMA). The commenters stated that, based on the acknowledgements by both the emissions control and the engine makers (and EPA's own technology assessments), they believe that the proposed standards for locomotive and marine engines are achievable within the proposed time frame. They further stated that the emission limits are achievable, as demonstrated by the MECA and EMA comments along with a body of experience in the highway sector. Environmental Defense, NRDC, et al. commented that the implementation timeframe and the level of the standards are subject to the protective legal mandates under section 213 of the CAA, and that they vigorously oppose any weakening or delay of the proposed standards. The commenters stated that they believe such backsliding would cause EPA to fall short of its mandatory duty to establish technology-forcing standards for locomotive and marine engines under the terms of the statute.

SCAQMD commented that, as stated by EPA, Tier 4 locomotive standards are feasible using today's technology; and it thus believes there is no need to delay implementation of the standards to await development of technology. The commenter also noted that EPA is required to adopt standards which "take effect at the earliest possible date," per CAA section 213(b). The commenter stated that it thus believes that the Tier 4 technology must be required as quickly as manufacturers can gear up to produce it. SCAQMD suggested that if such technology cannot be rapidly deployed on a nationwide basis, EPA should either adopt a regional rule or (at a minimum) require manufacturers to phase-in Tier 4 technology as early as possible nationwide, by starting with some level of production. The commenter requested that this occur no later than 2012, with full implementation as quickly as possible.

Letters:

Engine Manufacturers Association (EMA)	OAR-2003-0190-0575.1
Environmental Defense, NRDC, et al.	OAR-2003-0190-0592.1
South Coast Air Quality Management District (SCAQMD)	OAR-2003-0190-0558.1

Our Response:

EPA notes that unlike the provisions of section 202(a)(3) applicable to standards for certain emissions from on-highway heavy-duty engines, section 213 of the Clean Air Act contains no requirement for a specific amount of lead time for standards and contains no requirement that standards remain stable for any amount of time. Indeed, as some commenters point out, section 213(b) explicitly requires that standards "take effect at the earliest possible date considering the lead time necessary to permit the development and application of the requisite technology..." As discussed in section 3.2.1.2 of this Summary and Analysis of Comments document, we agree with the approach suggested by manufacturers of large engines that engines 2000-3700 kW could meet Tier 4 NOx in 2014 (two years earlier than proposed), if the Tier 3 NOx+HC standard, did not have to be met. We believe this approach is feasible, and would have very little detrimental effect on NOx reductions in 2012-2013, while providing significant additional NOx reductions thereafter. However, we believe that extending this change below 2000 kW is not appropriate because these smaller engines are more similar to their land-based nonroad counterparts, and therefore should be able to meet Tier 3 NOx levels without extensive redesign,; but, these engines would be more difficult to equip with aftertreatment on an early schedule due to vessel packaging constraints and other factors.

We note that EMA's point that less than one year of lead time is provided for small marine engine standards is expressed in the context of a statement that the proposed implementation dates are at the limit of feasibility and should not be shortened. We agree and believe that the 2009 start date provides appropriate lead time for the reasons discussed in preamble section III.B(2)(a). Likewise, EMA's point regarding the stability period between Tier 3 and Tier 4 for 1400-3700 kW is expressed in the same context. We note too that we have revised our final standards for engines in this group in response to manufacturer comments about lead time and need for flexibility, as described in section III.B(2)(a) of the preamble to the final rule.

The evidence provided in section III.C of the preamble to the final rule and chapter 4 of the RIA indicates that the stringent emission standards we are setting for newly-built and remanufactured locomotive and marine diesel engines are feasible and reflect the greatest degree of emission reduction achievable (per CAA sections 213(a)(3) and (5)) through the use of technology that will be available in the model years to which they apply. We have reviewed and given appropriate consideration to cost, cost-effectiveness, energy (including fuel efficiency), safety, and noise factors in setting these standards.

As discussed in section III.C of the preamble, further review of the test data previously available, and of new test data made available since the proposal (added to the public docket for this rulemaking), does support the argument for earlier implementation of Tier 4 NOx controls. Consequently, after considering this data and industry comments regarding feasibility, we have concluded that the progress made in the development of NOx aftertreatment technology has been such that this proposed allowance to defer NOx control is not consistent with our obligation under CAA section 213(a)(3) to set standards that "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, giving appropriate consideration to cost, lead time, noise, energy, and safety factors associated with the application of such technology." We are therefore not adopting this allowance for deferred NOx control in 2015-2016 Tier 4 locomotives, effectively advancing the Tier 4 NOx standard for locomotives by two years. Besides meeting our obligation under the Clean Air Act, this change will simplify the certification and compliance program for all stakeholders by providing a single step for Tier 4 implementation. It will also provide substantial additional NOx reductions during years that are critical to the states for state implementation plan (SIP) development, thus helping to address this concern.

As discussed further in section 10.2.1 of this Summary and Analysis of Comments document, we considered the time required to complete the necessary research, design, development, and validation activities, and we have concluded that 2015 is the most reasonable date for the introduction of the technologies we describe in Chapter 4 of the Final RIA.

8.2 Executive Orders

8.2.1 Environmental Justice and Children's Health Concerns

What Commenters Said:

Environmental Defense, NRDC, et al. noted that EPA concluded in the NPRM that the proposed rule is not subject to Executive Order 13045 "Protection of Children from Environmental Health Risks and Safety Risks," which requires the Agency evaluate the environmental health or safety effects of the planned rule on children, if children may be disproportionately affected. The commenters stated that they believe EPA incorrectly defended this decision based on an assertion that “the Agency does not have reason to believe the environmental health risks or safety risks addressed by this action present a disproportionate risk to children” (63 FR 16039). The commenters also noted that a review of the environmental health and safety effects of locomotive and diesel emissions on children was included in the DRIA.

Environmental Defense, NRDC, et al. commented that they appreciate EPA evaluating these effects in the DRIA; and stated that they also believe that such review is in fact called for under the plain terms of the Executive Order. The commenters noted that there is an extensive body of scientific evidence demonstrating that children are more vulnerable to the adverse health effects of diesel than adults because of the immaturity of their lungs and the protective metabolic enzyme systems, the larger lung surface area relative to body weight (children breathe 50% more air per kilogram of body weight than adults), and children spend more time outdoors and are more active than adults. The commenters thus requested that that EPA both acknowledge and evaluate the rule’s serious and disproportionate effects on children’s health arising from the suite of airborne contaminants in diesel exhaust that have been shown to place a heavy burden on children. The commenters also requested that EPA address that burden by taking final action on the proposal, as they believe that the most effective way for EPA to in fact address the disproportionate burden on children’s health is to promptly issue a final rule that puts in place rigorous emission standards.

NRDC also commented that it believes that locomotive and marine diesel pollution disproportionately affects the people and communities who live closest to the rail yards and ports. The commenter stated that in those communities, exposure to these emissions is likely to be far greater; and many of these communities are low-income and/or communities of color, giving rise to significant environmental justice concerns that underlie its interest in this rule-making.

The Oregon Environmental Council (OEC) stated that it believes that diesel emissions disproportionately impact vulnerable populations, such as children, elderly populations, and people of color.

<u>Letters:</u>
Environmental Defense, NRDC, et al. OAR-2003-0190-0592.1
Oregon Environmental Council OAR-2003-0190-0652
Natural Resources Defense Council (NRDC) OAR-2003-0190-0489

Our Response:

In regards to the comments related to the populations who live near rail yards and ports, particularly with regard to environmental justice concerns, EPA has appropriately addressed these items in sections II, IX.G, and IX.J of the preamble to the final rule, and Chapters 2 and 6 of the Final RIA. In short, EPA recently conducted an initial screening analysis of selected marine port areas and rail yards to begin to understand the populations living near rail yards and marine ports. This screening analysis indicated that at the 40 marine ports and 37 rail yards studied, at least 13 million people, including 3.5 million children and a high percentage of low-income households, African-Americans, and Hispanics, living near these facilities, are being exposed to elevated levels of diesel particulate matter. These populations will benefit from the controls being finalized by the rule because it increases the level of environmental protection for all affected populations.

EPA has evaluated several regulatory strategies for reductions in emissions from locomotive and marine diesel engines, and we believe that we have selected the most stringent and effective control reasonably feasible at this time (in light of the technology and cost requirements of the Clean Air Act). The programs being finalized today address both new engines and existing fleets of engines which will benefit the populations, including children, minority, and low-income populations, who live in proximity to marine ports and rail yards. In fact, the emission reductions from the stringent new standards finalized in the locomotive and marine diesel rule will have large beneficial effects on communities in proximity to port, harbor, waterway, railway, and rail yard locations, including children, low-income, and minority communities. In addition to stringent exhaust emission standards for new and remanufactured engines, the final rule includes provisions targeted to further reduce emissions from regulated engines that directly impact low-income and minority communities such as the mandatory idle reduction provision (see preamble section III.C(1)(c) for a detailed discussion on this provision), and emission standards for newly-built switch locomotives (which are major sources of pollution in urban rail yards).

With regard to the comment that EPA incorrectly stated that the proposed rule was not subject to Executive Order 13045 decision based on an assertion that the “the environmental health risks or safety risks addressed by this action present a disproportionate risk to children”, we would like to clarify that we stated that we believed that the rule itself was not subject to Executive Order 13045 because the proposed standards would have a positive effect on children’s health. Further, as noted in the NPRM and the Draft RIA, much of the analyses performed on the pollutants regulated by this rule were done in prior rulemakings. However, upon further study of the Executive Order, we do believe that the rule is subject to the Executive Order because the rule is economically significant and it “concerns an environmental health or safety risk that EPA has reason to believe may have a disproportionate effect on children.” We have thus evaluated the environmental health or safety effects of these risks on children, as discussed above, and in the preamble to the final rule (sections II and IX.G) and in the Final RIA (Chapter 2).

8.2.2 Consultation and Coordination with Indian Tribal Governments

What Commenters Said:

The Northwest Environmental Defense Center commented that EPA should reconsider the conclusion that the proposed rule has no tribal impacts under Executive Order 13175 (72 FR 16039), and that EPA should act to fulfill its tribal consultation duties under the Executive Order. The Puget Sound Clean Air Agency also commented that, under EPA’s Nation-to-Nation consultation responsibilities with the Tribal Nations, EPA has the ability within this rulemaking to be responsive to the concerns of these four Tribal Nations.

Letters:

Northwest Environmental Defense Center	OAR-2003-0190-0593.1
Puget Sound Clean Air Agency	OAR-2003-0190-0484 (hearing)

Our Response:

Executive Order 13175, entitled "Consultation and Coordination with Indian Tribal Governments", requires EPA to develop an accountable process to ensure "meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications." The final rule does not have tribal implications, as specified in Executive Order 13175, as the rule will be implemented at the Federal level and imposes compliance costs only on locomotive manufacturers, locomotive engine manufacturers, locomotive operators, locomotive remanufacturers, marine engine manufacturers, and marine vessel manufacturers. Tribal governments will be affected only to the extent they purchase and use the regulated engines and vehicles; thus, Executive Order 13175 does not apply. However, EPA did solicit additional comment on this rule from tribal officials. A comment was received from one tribal government; that comment is available in the rulemaking docket, and is summarized and addressed in other sections of this Summary and Analysis of Comments document.

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9. MARINE REMANUFACTURING CONCEPT

Background:

The comments in this section correspond mainly to Section VII.A.2 of the preamble to the proposed rule, and are therefore targeted at the marine remanufacture concept. A summary of the comments received, as well as our response to those comments, are located below.

The proposal contained an alternative that would address emissions from marine diesel engines in the existing fleet of marine vessels. These engines are expected to remain in the fleet for a long time, and will not be subject to the standards for new (or freshly manufactured) engines. Therefore, their emissions will remain high absent standards that apply when they are remanufactured.

The programmatic alternative consisted of a two-part program that would apply to all commercial marine diesel engines above 600 kilowatts (kW) when they are remanufactured. In the first part, which could begin as early as 2008, vessel owners/operators and engine rebuilders who remanufacture engines would be required to use a certified remanufacture system when an engine is remanufactured (defined as replacement of all cylinder liners, either in one event or over a five-year period) if such a certified system is available. During this first phase of the program, manufacturers would not be required to make remanufacture systems available. However, it is expected that they would do so voluntarily. For Category 2 (C2) engines, systems are expected to be available for those marine diesel engines that are derived from locomotive engines, as manufacturers can certify locomotive remanufacture systems for use on marine diesel engines. It is also expected that manufacturers would also make systems available for Category 2 engines, with system availability tracking the relative share of models to the total population of engines so that systems for the most popular engine models would be certified first.

In the second part, which could begin in 2013, a marine diesel engine identified by EPA as a high-sales volume engine model would have to meet specified emission requirements when it is remanufactured. Specifically, the remanufacturer or owner of such an engine would be required to use a system certified to meet the standard; if no certified system is available, he or she would need to either retrofit an emission reduction technology for the engine that demonstrates at least a 25 percent reduction or replace the engine with a new one. If an engine is not a high-sales volume engine, the requirements of the first phase would continue to apply (use a certified remanufacture system if one is available; if not, there is no requirement). This second part is similar to the mandatory emission limits for existing locomotive engines in that if an engine has been identified by EPA as a high sales volume engine, action would be required to be taken when the engine is remanufactured. EPA would work with the engine manufacturers to determine what engine models should be included in the mandatory second phase of the program, and the second phase could be subject to a technology review. Remanufacture systems would be subject to a price cap of $45,000 per ton of particulate matter (PM) reduced.

9.1 General Support for a Marine Remanufacture Program

What Commenters Said:

We received comments from many state and local government representatives and environmental groups who expressed support for the marine remanufacture program. Some of these commenters noted that such a program would result in greater emission reductions for the program overall. They said that given the long years of service for most commercial marine diesel engines a remanufacture engine program will both ensure early emission reductions and provide more reductions than new Tier 3 and Tier 4 engine standards on their own. One commenter suggested a marine remanufacture would also enhance the effectiveness of retrofit programs, since a marine engine that is removed as part of a repower would be required to be remanufactured before it can be sold to a different user as a used engine; this is an improvement over the current situation in which these engines can simply be rebuilt to their original configuration.

A few industry groups also expressed support for the concept of a marine remanufacture program. Electro-Motive Diesel, Inc. (EMD) stated that it supports the proposal for such a program, and noted that it has received requests from marine vessel operators for certified remanufacture engines but have been unable to fill them because the present marine diesel engine program does not contain provisions that allow certifying other than freshly manufactured engines. American Waterways Operators (AWO) noted in its initial written comments that while it has opposed requiring existing engines to meet standards that were not in effect at the time of original manufacture, recent industry experience suggests it may be possible to develop a targeted marine remanufacture program that would achieve emission reductions without imposing undue hardship on owners. Kirby Corporation commented that it is committed to considering means to address emissions from existing vessels, but such a program should take into account the unique operating environment and technical challenges of developing such a program for marine diesel engines.

<u>Letters:</u>
American Lung Association, et al. OAR-2003-0190-728
American Waterway Operators (AWO) OAR-2003-0190-0519
City of Houston (Texas) Bureau of Air Quality Control (BAQC) OAR-2003-0190-0561.1
California Air Resources Board OAR-2003-0190-0596.1, 0719
Clean Air Task Force (CATF) OAR-2003-0190-0499 (hearing)
Clean Air Watch OAR-2003-0190-0500 (hearing)
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502, 0594, 0729
Environmental Defense OAR-2003-0190-0592.1
Kirby Corporation OAR-2003-0190-0563
National Association of Clean Air Agencies (NACAA) OAR-2003-0190-0495, 0732

Natural Resources Defense Council (NRDC) OAR-2003-0190-0489 (hearing)
New Jersey Department of Environmental Protection, Air Quality Management (NJDEP) OAR-2003-0190-0562.2
New York Department of Environmental Conservation, Office of Air Resources OAR-2003-0190-0583.1
Northwest Environmental Defense Center, Oregon Toxics Alliance, Columbia Riverkeeper, Friends of the Columbia Gorge, and Northwest District Association Health and Environment Committee OAR-2003-0190-0593.1
Oregon Department of Environmental Quality, Air Quality Division OAR-2003-0190-0506, 0652
People for Puget Sound OAR-2003-0190-0649
Private Citizens *various*
Puget Sound Clean Air Agency OAR-2003-0190-0484 (hearing)
Wisconsin Department of Natural Resources, Bureau of Air Management (WDNR) OAR-2003-0190-0552

Our Response:

EPA agrees with these commenters about the need to address emissions from engines in the existing fleet of marine vessels that will not be subject to the new Tier 3 and Tier 4 standards. We also agree that such a program should take into account the special operating and technical challenges associated with marine diesel engines, and we consulted with engine manufacturers and users to obtain their feedback on key elements of the program. The remanufacture program we are finalizing is an important step toward reducing emissions from the engines that are in the marine fleet the longest and that are the largest contributors to diesel marine air pollution.

9.2 Opposition to a Marine Remanufacture Program

What Commenters Said:

A few commenters were opposed to a program for remanufactured marine engines, mainly as a result of their specific situations. The Makah Tribal Council indicated that while it supports the more stringent Tier 3 and Tier 4 marine diesel engine standards, they do not support standards for remanufactured commercial marine engines. The commenter noted that the Tribal Fleet is comprised of 45 to 50 privately owned long-line and troll fishing vessels, and that most of the engines are between 200 and 500 hp. The commenter was concerned about the burden this program would place on its members. Marathon Petroleum Company was also opposed. The commenter noted the diversity of engines used in the marine sector and stated that EPA cannot require a “one size fits all” provision and provide for cost effective emission reductions from existing engines.

In its initial written comments, the Engine Manufacturers Association (EMA) also indicated that it is not a proponent of a marine remanufacture program, due to the diversity of the engines involved and the fact that there are no remanufacture systems that are currently approved or on the horizon. However, the commenter provided several suggested provisions that should be considered if EPA were to adopt such a program, and in a later set of comments the commenter expressed support for a program that requires the use of a certified remanufacture system only if one is available, along the lines of the program contained in the draft regulations that were made available September 10, 2007. Caterpillar recommended that a marine remanufacture program should not be adopted as part of this rule, but also offered some suggestions for a future program.

The Passenger Vessel Association (PVA) commented that instead of a regulatory program EPA should focus on incentive programs to bring about a similar result. The commenter noted that in making the decision to remanufacture or repower, vessel operators will decide based on economics. Existing engines will be replaced at an accelerating rate as the cost of maintaining the older engine increases, the cost of fuel increases, and the engine approaches the end of its economically useful life. The commenter suggested that EPA can reinforce these individual assessments through a public information program that would educate the marine industry on the benefits to the environment of repowering or rebuilding with emission reducing kits, promotional activities such as the National Marine Manufacturers Association (NMMA) "Grow Boating" program, participation in industry conferences and trade shows, and using the power of the media to publicize success stories.

Letters:
Caterpillar	OAR-2003-0190-0591
Engine Manufacturers Association (EMA)	OAR-2003-0910-0575, 0726
Makah Tribal Council	OAR-2003-0190-0472 (hearing)
Marathon Petroleum Company LLC	OAR-2003-0190-0595.1
Passenger Vessel Association (PVA)	OAR-2003-0190-0576

Our Response:

EPA is sensitive to the concerns expressed by these commenters, and we took them into account when we developed the final program. The final program applies only to commercial marine diesel engines above 600 kW (800 hp) and applies only to those that are remanufactured (all cylinder liners replaced either all at once or within a 5-year period). The smaller engines operated by these groups will not be affected by the program. In addition, engines on vessels that are used only for low annual hours are unlikely to be affected since they are unlikely to be remanufactured on the schedule set out by the program, if at all.

While an incentive-based program along the lines suggested by PVA is theoretically possible, we believe it would not achieve the emission reduction goals achievable through this marine remanufacture program. This is because marine diesel engines used in commercial applications are often kept in service for extended periods of time, well over 25 or 30 years, both because they are durable and reliable and because it is difficult to remove them from a vessel. This makes replacing an engine a relatively expensive proposition, and it is not clear that an incentive scheme could be designed to make the decision to replace an engine more attractive than retaining an existing engine, especially for engines in heavy-use commercial applications. We believe that a program based on the use of certified remanufacture systems is preferable both because the costs to the owners are smaller than retrofits and because systems can be designed that will not require significant modification of the base engine. Consequently, a systems-based program would encompass more engines and result in greater emission reductions.

EMA's and Caterpillar's comments are addressed in our response to section 9.3, below.

9.3 Support for Part 1 Program; Opposition to Mandatory Retrofit Program

What Commenters Said:

Several commenters, while they did not oppose the concept of a marine remanufacture program, did not support the two-part program set out in the proposal.

General Electric Transportation (GE) commented that it believes that in general, the technology and opportunity to apply emissions improvements to marine engines at the time of remanufacture is equivalent to that for locomotives. The commenter noted that there are several upgrades that can be done without changing the footprint of the engine and without significantly affecting other systems on the vessel, such as vehicle control and cooling. GE also commented that, while there may be some engine families or engine models that are small in number or so unique that it may not be economical or practical to expect an emissions upgrade kit to be developed, it recommends that EPA make application of an upgrade kit mandatory at the time of remanufacture if a certified kit is available.

AWO and Kirby recommended a program that would apply only to Category 2 marine diesel engines. They noted that Category 2 engines are larger, burn more fuel, and are less frequently replaced than Category 1 engines. In addition, such a program could be designed similar to the locomotive remanufacture program. Specifically, the first phase of the program could begin 12 months after publication of the rule and could require the use of a certified remanufacture system that meets the locomotive Tier 0 standards; it would apply at the first remanufacture after the effective date. The second phase could also be based on the new locomotive Tier 0 and Tier 1 standards.

EMD also recommended a program based on the locomotive remanufacture program. However, the commenter suggested that the program be voluntary and that there should be no emission reduction requirement if a certified remanufacture system is unavailable. The commenter opposed a mandatory requirement because if the alternative is to retrofit a control device or repower, owners may choose to not rebuild their engines at all. EMD noted that an older engine that is simply rebuilt is preferable to one that is not rebuilt at all.

CIMAC commented that the program should not be applied to engines that do not have a locomotive counterpart. The commenter's concern stems from the existence of many old marine engine types that have not been regulated and consequently have no emission data available. Manufacturers of these engines may not be in a position to test these engines or develop remanufacture systems as they are focusing on developing and testing engines to meet the new tiers of standards. In addition, the manufacturers of some old engines may not be in business anymore.

Kirby expanded on this concern about Category 1 engines. There is a great variety of engines installed on existing vessels, and there are currently no certified remanufacture systems or approved retrofit technologies for all of those engines. As a result, under Phase 2, owners could face a considerable expense if they are required to replace their engines. This could place them at a disadvantage compared to any competitors who do not remanufacture.

The Lake Carriers Association (LCA) expressed similar concerns. The commenter noted that some engines are no longer manufactured or are used so little that development of a kit is not economically warranted. Many older engines are unregulated and therefore there is no emission data available, and obtaining that data would be expensive. The commenter noted that the requirement in Phase 2 that an engine for which a remanufacture system is not available be retrofit or replaced would place an economic burden on their members, and steps would have to be taken (e.g., tax incentives and accelerated depreciation) to ease that burden.

As noted above, Caterpillar does not support adopting a marine remanufacture program in this rule. However, the commenter made several recommendations for such a program: it should be based on fully developed and certified retrofit kits, it should be voluntary, and it should begin no earlier than 2010. Also, kits should be required only at the time of a major overhaul of the engine.

EMA also did not support a remanufacture program in their initial written comments but made certain suggestions for such a program. The commenter recommended that the program apply only to engines that are at least 15 years old and are above 600 kW; Tier 2 and later engines should not be included in the program; the standards must not require aftertreatment; and the program should be subject to a technology review in 2011. The commenter further recommended the program should target a 25 percent reduction in PM emissions only; should require the use of rebuild kits only if they are commercially available, subject to a price cap, that the kits be verified, and that they not interfere with the durable and safe operation of the engine and vessel.

Letters:
American Waterways Operators (AWO) OAR-2003-0190-0574, 725
Caterpillar OAR-2003-0190-0591
CIMAC Exhaust Emission Controls Working Group OAR-2003-0190-0548.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502, 0594, 0729
Engine Manufacturers Association (EMA) OAR-2003-0190-0545 (hearing), 0575, 726
General Electric Transportation (GE) OAR-2003-0190-0590

Kirby Corporation OAR-2003-0190-0563.1
Lake Carriers Association (LCA) OAR-2003-0190-0567.1

Our Response:

EPA remains committed to reducing emissions from marine engines in the existing fleet. However, these comments compelled us to re-examine the 2-part program described in the proposal. We engaged in several one-on-one discussions with engine manufacturers and user groups to clarify the constraints outlined above, especially with respect to Category 1 (C1) engines and the concern that certified remanufacture systems would not be available for all existing engine models by the time the second phase of the program would begin, in 2013. Engine manufacturers explained that their current product lines are very diverse and it would be difficult for them to develop remanufacture systems for all types of engines. Furthermore, some models have very small annual sales and it may not be cost-effective for them to develop systems.

Owners, on the other hand, expressed their concerns about the expense of individual retrofits or repowers if remanufacture systems are not available. There was also concern that the mandatory Phase 2 would provide engine manufacturers with an economic incentive not to provide remanufacture systems as the repower alternative could be more attractive for them. In addition, as Kirby noted in its written comments, the price of remanufacture systems is hard to predict and may vary greatly among engine models and engine manufacturers depending on how many engines are in the existing fleet over which the costs of developing a remanufacture system can be spread.

The program we are finalizing addresses these comments by deferring Phase 2 of the program, covering only the larger commercial diesel marine engines, and requiring use of a remanufacture system only if one is available. We are adopting a market-oriented program according to which the owner of a covered engine would be required to use a certified remanufacture system when remanufacturing that engine if such a system is available. If there is no certified system available at that time, there is no requirement. Engine manufacturers are not required to make remanufacture systems available by a certain date for any engine. Instead, they would certify such systems on a voluntary basis. It is expected that they will respond to market signals, providing systems for those engines with the highest sales volumes first. We are also providing a streamlined certification process for locomotive remanufacture systems for use on marine engines. The program will begin June 1, 2008, although the requirements do not begin until marine remanufacture systems are certified and made available. The draft regulations that were made available to stakeholders on September 10, 2007, reflect these changes.[1]

We expect that the program we are finalizing, which relies on manufacturers to provide remanufacture systems and facilitates the use of locomotive remanufacture systems on marine engines derived from locomotives, will result in significant, early reductions from the large

1 EPA-HQ-OAR-2003-0190-0723

commercial marine diesel engines engine that are responsible for a significant share of the marine inventory while avoiding the higher compliance costs associated with one-off engine retrofits or repowers. If, as expected, locomotive remanufacture systems are made available for C2 engines, and if C1 engine manufacturers provide remanufacture systems for their largest sales volume engines (as measured by the number of engines in the existing fleet), we expect this program to yield emission benefits comparable to those estimated for the mandatory program.

Given the level of the marine remanufacture program standards and the technologies that will be used to achieve them we do not believe a technology review is necessary for this program. However, we are committed to the development and successful operation of a marine remanufacture program. We intend to assess the effectiveness of this program as early as 2012 to ascertain the extent to which engine manufacturers are providing certified remanufacture systems. If remanufacture systems are not available or are not in the process of being developed and certified at that time for a significant number of engines, we may consider changes to the program. In evaluating the effectiveness of the remanufacture program in the future, we may revisit the need for Part 2, or something similar, to ensure emission reductions from the large marine legacy fleet are occurring in a timely and effective manner. We may also evaluate other aspects of the program, including the criteria that trigger a remanufacturing event (including the 5-year period for incremental remanufactures), and whether the program should also apply to engines less than 600 kW. Revisions, if necessary, will be pursued in a separate rulemaking.

9.4 Supplemental Comments – Support for Marine Remanufacture Program

What Commenters Said:

In their supplemental comments, AWO expressed support for the voluntary program described in the proposed regulations made available on September 10, 2007, and noted that the program offers a reasonable way to achieve near-term emissions reductions from those marine diesel engines that account for the largest share of engine emissions from marine vessels. EMA noted its interest in trying to accommodate EPA's stated goal to implement some sort of voluntary marine engine rebuild program, and provided several additional suggestions.

<u>Letters:</u>

American Waterways Operators (AWO)	OAR-2003-0190-0574, 725
Engine Manufacturers Association (EMA)	OAR-2003-0190-0545 (hearing), 0575, 726

Our Response:

EPA agrees that this program is an important step forward in controlling emissions from existing marine diesel engines.

9.5 Legal Authority

What Commenters Said:

EMA noted that Clean Air Act (CAA) sections 213(a)(3) (42 U.S.C. § 7547(a)(3)) and 213(c) (42 U.S.C. § 7547(c)) impose key constraints on EPA's authority to establish emission standards for new marine engines - specifically, technological feasibility, cost-effectiveness, and safety. The commenter noted that EPA does not have the legal authority to adopt or enforce requirements for nonroad engines (including marine engines) that are no longer "new," as CAA Section 213(a) (42 U.S.C. § 7547(a)) expressly limits EPA's standard-setting authority to "new nonroad engines and new nonroad vehicles." The commenter stated that, in that regard, CAA Section 216(3) (42 U.S.C § 7550(3)) defines a "new" engine as one in which "the equitable or legal title to which has never been transferred to the ultimate purchaser" (i.e., the first person who in good faith purchases the engine for purposes other than resale). The commenter stated that EPA has vigorously defended this restrictive definition of "new" in the context of standard setting and federal preemption (EMA v. EPA, 88 F.3d 1075 (D.C. Cir. 1996)). EMA thus commented that it does not believe that EPA has the legal authority to establish emission control standards for marine engines that are no longer new, including marine engines that are being remanufactured after several years of in-use operation.

Environmental Defense, the Natural Resources Defense Council (NRDC), et al. commented that EPA is required to apply technology-forcing emission standards to remanufactured marine diesel engines, as section 213(a)(3) directs EPA to "promulgate (and from time to time revise) regulations containing standards applicable to emissions from those classes or categories of new nonroad engines and new nonroad vehicles (other than locomotives or engines used in locomotives) which in the Administrator's judgment cause, or contribute to," air pollution. The commenter stated that Congress took a comprehensive approach in delegating rulemaking responsibility to EPA, calling for the establishment of emission standards that apply to new vehicles and engines, and included language to ensure that remanufactured engines—engines that are functionally new—cannot elude protective emission standards. The commenters noted that such an approach follows inextricably from the statutory text and is essential to carry out the core statutory purpose of section 213—to address emissions from new engines, based on the natural and ordinary understanding of that term, that endanger public health and welfare—and stated that they believe that taking a different approach would be arbitrary and capricious, an abuse of discretion, and contrary to law.

<u>Letters:</u>

Engine Manufacturers Association (EMA)	OAR-2003-0190-0545 (hearing), 0575.1
Environmental Defense, NRDC, et al.	OAR-2003-0190-0592.1

Our Response:

Regarding the definition in section 216(3), that is the definition of "new motor vehicle," while EPA has generally followed that definition for determining "new" in the context of nonroad engines and nonroad vehicles, and believes it generally to be an appropriate guide, EPA has made clear in the past, with regard to locomotives, and now, with regard to larger marine diesel engines, that the remanufacturing process for such engines, which stay in service much longer than typical motor vehicle engines, is so thorough as to return the engine to as-new condition, and thus should make the engine subject to section 213.

Our statutory authority to set standards for marine diesel engines is found in section 213(a) of the Clean Air Act. That section authorizes establishment of standards for "new" engines. EPA has previously determined that certain existing locomotive engines, when they are remanufactured, are returned to as-new condition and are expected to have the same performance, durability, and reliability as freshly-manufactured locomotive engines. Because these remanufactured engines are for all intents and purposes "new," we consequently set emission standards for these engines that apply at the time of remanufacture (defined as "to replace, or inspect and qualify, each and every power assembly of a locomotive or locomotive engine, whether during a single maintenance event or cumulatively within a five-year period…" (see 61 FR 53102, October 4, 1996; 40 CFR 92.2). This rulemaking adopts new tiers of standards for both freshly manufactured and remanufactured locomotives.

We are extending this interpretation of "new" to marine diesel engines. This is appropriate because, like with locomotives, many marine diesel engines, particularly those above 600 kW, periodically undergo a maintenance process that returns them to as-new condition. A full rebuild that brings an engine back to as-new condition includes a complete overhaul of the engine, including piston, rings, liners, turbocharger, heads, bearings, and geartrain/camshaft removal and replacement. Engine manufacturers typically provide instructions for such a full rebuild, and describe engines that undergo such a rebuild as "as-new."[2] Marine diesel engine owners complete this process to maintain engine reliability, durability, and performance over the life of their vessel, and to avoid the need to repower (replace the engine) before their vessel wears out. A commercial marine vessel can be in operation in excess of 40 years, which means that a marine diesel engine may be remanufactured to as-new condition three or more times before the vessel is scrapped.

Because these remanufactured engines are returned to as-new condition, sections 213(a)(3) and (4) give EPA the authority to set emission standards for those engines. We are adopting requirements for remanufactured marine diesel engines. For the purpose of this program, we are defining remanufacture as the replacement of all cylinder liners, either in one maintenance event or over the course of five years (for the purpose of this program, "replacement" includes the removing, inspecting and requalifying a liner). While replacement of cylinder liners is only one element of a full rebuild, it is common to all rebuilds. Marine diesel engines that do not have their cylinder liners replaced all at once or within a five-year period, or that do not perform cylinder liner replacement at all, are not considered to be returned to as-new condition and therefore are not considered to be remanufactured or new. Those engines would not be subject to the marine remanufacture requirements.

2 See Note from Amy Kopin, Mechanical Engineer, to Jean Marie Revelt, EPS, Re: Marine Remanufacture Program. A copy of this Note is available in Docket OAR-2003-0190.

With regard to the definition in section 216(3), that is the definition of “new motor vehicle,” while EPA has generally followed that definition for determining “new” in the context of nonroad engines and nonroad vehicles, and believes it generally to be an appropriate guide, EPA has made clear in the past, with regard to locomotives, and now, with regard to larger marine diesel engines, that the remanufacturing process for such engines, which stay in service much longer than typical motor vehicle engines, is so thorough as to return the engine to as-new condition, and thus should make the engine subject to section 213. As noted above, a full rebuild brings an engine back to as-new condition, and engine manufacturers describe remanufactured engines to be as good as new. While a full rebuild can vary by engine model and engine manufacturer, one element in common in all full rebuilds is replacement of cylinder liners. Therefore, we are defining a remanufactured engine to be an engine that is brought back to as-new condition as evidenced by the replacement of all cylinder liners within a five year period (see Section 9.8, below).

9.6 Separate Regulatory Action

What Commenters Said:

Several industry commenters said EPA should defer action on a marine remanufacture program to a separate rulemaking. These commenters noted that the marine market is very diverse in terms of number of engine manufacturers, engine models, and users, and deferring to a separate rule would allow more time for all stakeholders to consider the program. Some of the commenters wrote that more time is needed to assess the implications on the marine industry of a mandatory program patterned after the locomotive remanufacture program. One commenter said that all the “unknowns,” “maybes” and “hoped fors” in the preamble suggests the need for a separate rule. Some commenters pointed out that the proposal did not include draft regulations for the program, and that stakeholders would need time to review the draft regulations when they became available.

PVA suggested that some applications may need a different program. For example, there are engines above 600 kW in passenger vessel service that approximate the use and maintenance practices of engines below 600 kW. These engines are used in low demand, intermittent, seasonal applications and do not have the operating characteristics of large commercial engines. The commenter suggested establishing separate criteria for these engines and supported a continued exploration of the remanufacture program through ongoing dialogue and a separate rulemaking, if needed.

After reviewing the proposed regulations made available in the docket on September 10, 2007, AWO expressed support for a voluntary program in supplemental comments and indicated that a supplemental notice of proposed rulemaking with a formal comment period would be required if EPA wanted to go beyond a voluntary program.

Letters:

American Waterways Operators (AWO) OAR-2003-0190-0574, 725
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0591.1
Cummins Inc. OAR-2003-0190-0559, 731
Engine Manufacturers Association (EMA) OAR-2003-0190-0545 (hearing), 0575.1
Kirby Corporation OAR-2003-0190-0563.1
Lake Carriers Association (LCA) OAR-2003-0190-0567.1
Passenger Vessel Association (PVA) OAR-2003-0190-0576.1
Port of Seattle OAR-2003-0190-0469.1

Our Response:

See response to section 9.3, above. The program we are finalizing does not include the mandatory Phase 2 described in our proposal. Because the final program is a market-based program that relies on the voluntary certification of remanufacture systems, we do not think it is necessary to postpone adoption to a separate rulemaking. With regard to the diversity of applications that use the covered engines, we disagree that differences among uses requires separate rules or provisions. The requirements are tied to how a vessel is maintained and whether or not it is remanufactured. Vessels in any application that are remanufactured to as-new condition through the replacement of cylinder liners are subject to the standards; those that have lower usage rates and are not remanufactured will not be affected by the program.

We intend to monitor implementation of the marine remanufacture program and will review the program as early as 2012 to determine if revisions are needed to obtain the emission reductions anticipated by this program. Revisions, if necessary, will be pursued in a separate rulemaking.

The final regulatory provisions are consistent with the concept EPA announced in the proposed rule. We also made draft regulations available to all stakeholders on September 10, 2007, by e-mailing them to all groups who commented on the rule (excluding private citizens), by inserting them in the docket for this rule, and by adding them to our website.

As is clear from the comments, the proposal fairly apprised commenters of the issues at stake in adopting a diesel marine remanufacturing program, EPA provided draft regulations to stakeholders in a timely manner, and EPA has met with the affected industry to address their concerns. A supplemental notice is not necessary to further develop the program.

9.7 Engines Covered

Background:

The marine remanufacture program described in the proposal would apply to all remanufactured (defined as replacing all cylinder liners, either at once or in a five-year period) commercial marine diesel engines above 600 kW. We requested comment as to whether the program should be expanded to include engines below 600 kW as well. We originally expected to apply the program to all marine diesel engines. Although we requested comment as to whether the program should be limited to engines built after 1973, the program described in our September 10, 2007 memo subsequently limited the program to engines built after 1973. We also requested comment on whether all engines onboard a vessel should be subject to the remanufacturing requirements if the main propulsion engine falls under the scope of the program.

What Commenters Said:

Many commenters from state and local governments and environmental groups argued for a broad-based program and recommended that EPA extend the coverage of the marine remanufacture program and include all existing C1 and C2 vessels. They also recommended that the second phase of the program not be restricted to just high-sales volume engines.

Manufacturers and user groups, on the other hand, advocated applying the program only to Category 2 marine diesel engines, with some specifying it should apply only to those Category 2 engines larger than 600 kW. Some of these commenters noted that this approach would make maximum possible use of components developed for rail engines for C2 engines (see section 9.3, above). According to these commenters, this approach is appropriate because Category 2 engines are larger, burn more fuel, produce more emissions, and are less frequently replaced. In addition, these engines are designed to be maintained on board the vessel and components are replaced or repaired as they wear, and that components such as heads, liners and pistons may be repaired or renewed on individual cylinders over a period.

Other commenters did not support a remanufacture program for Category 2 engines. These commenters noted that Category 2 engines are maintained onboard and are not remanufactured but instead are rebuilt onboard, and there may not be room for remanufacture systems. These commenters also noted that the remanufacture program should apply only to engines operated on distillate fuel. They stated that marine engines that operate on residual fuel have no counterpart among locomotive engines, and therefore the locomotive remanufacture systems would not be applicable. In addition, it would be necessary to specify a PM test measurement method for residual fuel engines.

With regard to the age of engines, EMA recommended in its initial comments that the requirements should apply only to engines above 600 kW that are at least fifteen years old, and that Tier 2 engines and later engines should be exempt. In its supplemental comments, EMA recommended that the program apply to Category 2 engines only. The commenter noted that many Category 1 engines are already being rebuilt to Tier 1 standards and that those emission benefits will continue to be realized even if the voluntary remanufacture program is limited to Category 2 engines. This would also limit issues associated with "will-fitters" (see section 9.11 below).

With regard to the size threshold, at least two commenters, PVA and Kirby, indicated that

600 kW is the appropriate lower limit for the program, noting it is identical to the Tier 4 standards size threshold. PVA also recommended that a vessel be grandfathered if it can be shown that a certified remanufacture system won't fit a vessel.

Two commenters recommended that EPA not adopt a requirement to treat all engines onboard as a system and require all to be remanufactured if the main propulsion engine falls under the program. Kits may not be available for the smaller engines and the costs of retrofitting or replacing them would be prohibitive.

PVA also questioned the need for the marine remanufacture program, stating that existing engines will be replaced in an accelerating rate as the cost of maintaining older engines increases, the cost of fuel increases, and the engine approaches the end of its economically useful life. EPA can reinforce this turnover through initiatives and information programs. PVA also noted that there are engines above 600 kW in passenger vessel service that approximate the use and maintenance practices of engines below 600 kW. These engines are used in low demand, intermittent, seasonal applications and do not have the operating characteristics of large commercial engines.

The Makah Tribal Council noted that given that recreational boat owners do not depend on their vessels as a way to make a living, the Makah Tribe does support the application of these standards to the remanufacture of engines in non-commercial, or recreational vessels that fall into the 50 hp to 5 liter category.

The California Air Resources Board (CARB) expressed concern about the interface between this remanufacture program and existing state retrofit programs. Specifically, there may be a situation where a vessel owner has already applied a retrofit device achieving greater than a 25 percent PM reduction, in response to State and local agency direction. Then, when the engine needs a rebuild, the vessel owner who has already installed a retrofit would be required to rebuild with the certified EPA kit. This could result in the necessity of removing the retrofitted device. The commenter recommended that language be added to the effect that a certified EPA remanufactured (rebuild) engine emission control system must be used unless the vessel owner can demonstrate that an emission reduction system has already been applied that achieves equal or greater reductions than the required EPA-certified system.

Letters:
American Waterways Operators (AWO) OAR-2003-0190-0574.1
California Air Resources Board (CARB) OAR-2003-0190-0596.1
CIMAC Exhaust Emission Controls Working Group OAR-2003-0190-0548.1
Crowley Maritime Corporation (Crowley) OAR-2003-0190-0641, 659
Cummins Inc. OAR-2003-0190-0559, 731
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502 (hearing), 0594, 0729
Engine Manufacturers Association (EMA) OAR-2003-0190-0545 (hearing), 0575, 726
Kirby Corporation OAR-2003-0190-0563.1
Lake Carriers' Association (LCA) OAR-2003-0190-0567.1

Marathon Petroleum Company LLC OAR-2003-0190-0595.1
Makah Tribal Council OAR-2003-0190-0472
National Association of Clean Air Agencies (NACAA) OAR-2003-0190-0732
Overseas Shipholding Group, Inc. (OSG) OAR-2003-0190-0589.1
Passenger Vessel Association (PVA) OAR-2003-0190-0576.1
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0483 (hearing)

Our Response:

See response to 9.3, above. Because the final program is a market-based program that relies on the voluntary certification of remanufacture systems, we do not think it is necessary to limit the program to Category 2 engines only. Many of the emission control technologies that are being used to achieve the marine Tier 2 standards, and the technologies that are expected to be used to achieve the marine Tier 3 standards, can be applied to many existing marine diesel engines, particularly those that have the same basic engine platform as the Tier 2 or Tier 3 engines. However, engine manufacturers might not develop remanufacture systems for Category 1 engines unless owner/operators of those engines would be required to use those certified systems when they become available. EMA noted that it is unnecessary to include Category 1 engines in the program because many are already being rebuilt by engine manufacturers to Tier 1 (International Maritime Organization (IMO) Annex VI-compliant) standards. We disagree with such an approach. A certification requirement such as that adopted in the marine remanufacture program serves three important purposes. First, it ensures that a technologically-feasible PM emission reduction, 25 percent, can be achieved. Second, it requires the engine manufacturers to demonstrate that the emission reductions will actually occur over the useful life of the engine. Finally, it requires the vessel owner/operator to maintain the engine such that the emission reductions are achieved in-use. As a final note, the IMO Annex VI limits are for NOx only.

With regard to the comment that it is inappropriate to apply remanufacture requirements to Category 2 engines because they are maintained onboard, we don't agree that this should exempt them from the program. In our conversations with engine manufacturers, we learned that these engines are often designed to be a key component of the structure of the vessel. The location of the engine as well as its fuel and control systems is important both in terms of the stability of the vessel and in terms of vessel operation. These constraints make the engine difficult, if not impossible to remove. As a result, the engines are designed to last the life of the vessel, which can be upwards of 30 years. This also means that the engine must be designed to be serviced on the vessel, since removal of major components such as cylinder blocks or crankshafts would often mean cutting into the hull of the vessel. The engines are designed for easy in-situ repairs so that those parts subject to wear can be replaced without difficulty, to minimize the time that the unit is out of service for repair or rebuild. This includes power assemblies, which consists of the pistons, piston rings, cylinder liners, fuel injectors and controls, fuel injection pump(s) and controls, and valves. The power assemblies are generally rebuilt to bring them back to as-new specifications, or they can be upgraded to incorporate the latest design configuration for that engine. As part of the routine rebuilding process, many types of power assemblies and key engine components can be disassembled and replaced or requalified (i.e., determined to be within original manufacturing tolerances). The ability of these engines to undergo a major rebuild without being removed makes them candidates for the marine remanufacture program. We acknowledge that there may be space constraints that could limit the types of technologies that can be applied to existing engines, although it is also the case that many commercial engines are located in engine rooms where space is not so constraining. In any case, the standards we are finalizing do not require the use of aftertreatment technologies, and can be achieved by using modified versions of the same parts that are currently replaced during a major engine rebuild.

While several commenters supported applying the program to smaller engines (those below 600 kW) as well, we did not receive any technical justifications for broadening the program. At this time, we do not have sufficient data to determine the extent that the rebuilding of engines below 600kW qualifies as remanufacturing to an as new condition. Therefore, we are defining “remanufacture” in §1042.901 to exclude engines below 600 kW from the program. There are also significant policy reasons to support this approach. Most significantly, these engines have shorter lives than those above 600 kW and are not designed to be rebuilt several times. Instead, they are more likely to be replaced with a new engine when they reach the end of their useful life. This is supported by the comments from PVA, who noted that owners will replace owners as it becomes economical to do so either due to decreased maintenance or increased fuel efficiency.

Similarly, we cannot conclude that rebuilding recreational engines qualifies as remanufacturing. Recreational engines also have shorter useful lives than commercial engines and are not subject to as much wear on an annual basis. This means it takes longer to acquire the hours between maintenance intervals. Engines on some recreational marine vessels may not be rebuilt at all but, instead, are replaced or the vessel is scrapped. There may also be other technological and cost issues with applying the remanufacture definition to smaller commercial or recreational engines. We may revisit this approach after implementing the program to evaluate whether other marine diesel engines should be included as remanufactured engines as well.

Because the program we are finalizing simply requires the use of a certified remanufacture system when an engine is remanufactured, if one is available, we are including all marine diesel engines above 600 kW, regardless of the type of fuel they use. While the technologies that can be used to reduce PM emissions from residual fuel engines may be different, there are steps that can be taken, such as changes in cylinder liners to reduce oil consumption. The marine remanufacture program would encourage manufacturers to consider such technologies since owners would be required to use a certified remanufacture for residual fuel engines if one is available. Note that while we are allowing someone to certify a remanufacture system for residual fuel engines that simply requires the use of distillate fuel in an engine, §1042.801 specifies that such systems would not trigger the availability requirements. We specify that any kit based on fuel or fuel additives would need to be certified in the same way as an engine-based system, in addition to being registered as a fuel or fuel additive under 40

CFR Part 79. It will be necessary to include emission testing data for the engine models included in the certificate, a description of any modifications that must be made to the engine to accommodate the fuel or fuel additive, a sampling method, and a compliance verification method.

We are not adopting a requirement that all engines on a vessel be remanufactured if the main propulsion engines falls under the program, for the reasons set out by the commenters (kits may not be available for these engines and the costs of retrofitting or replacing could be burdensome, depending on the number of engines on the vessel and the steps that are required to be taken to reduce the PM emissions).

With respect to PVA's comment on engines above 600 kW that have the same usage patterns as recreational engines, to the extent this is the case then those engines are unlikely to trigger the requirements as they are unlikely to be remanufactured. Specifically, the remanufacture event that triggers the requirements is defined as when all cylinder liners are replaced, either all at once or in a five-year period. Engines on passenger vessels that are used in lighter applications than most commercial vessels, and/or that aren't subject to as much wear on an annual basis, are unlikely to be remanufactured. Those that are used many hours are appropriately included in the program.

With respect to PVA's request that a vessel be grandfathered if a certified system won't fit a vessel, we expect that remanufacture systems are expected to be improved versions of the parts that are currently replaced in a thorough rebuild and that such a provision is not necessary. The remanufacture standard, a 25 percent reduction in PM emissions, is not expected to require the use of aftertreatment or any other additional components for the engine. Further, to certify a remanufacture system the manufacturer has to demonstrate that the cost of the system will not exceed $45,000 per ton of PM reduced, and those costs must take into account any vessel modifications if they are necessary.

With respect to EMA's recommendation about the scope of the program, we are not revising the program to include only those marine engines above 600 kW that are at least 15 years old, nor are we exempting Tier 2 engines. Instead, the program will apply to engines manufactured from 1973 through Tier 2. The beginning date of 1973 is based on our existing locomotive program; many of the techniques used to achieve those standards are expected to be applicable to marine diesel engines over 600 kW. Similarly, Tier 2 remanufacture systems will be available for the locomotive counterparts of these engines and those technologies should be transferable to marine engines. To the extent there are technological difficulties in achieving the emission reductions for any particular engine model, the program does not require that a system be made available. It only requires the use of a certified remanufacture system when remanufacturing a marine engine if such a system is available. With regard to EMA's comment on will-fitters, see response to comment 9.11, below.

With respect to the concerns about possible inconsistency between EPA's marine remanufacture program and existing state or local retrofit programs, we don't want to negatively impact the positive benefits that arise from state and local retrofit programs, especially in those cases in which the retrofit achieves a greater reduction (e.g., retrofit of a selective catalytic reduction (SCR) system) than a certified marine remanufacture system. We also don't want to discourage these programs especially in early years where state and local programs may achieve reductions before certified remanufacture systems become available. Therefore, we are adopting a provision that will allow an owner/operator of an engine that is fit with a retrofit device prior to 2017 pursuant to a state or local retrofit program to request a qualified exemption from the marine remanufacture requirements for that engine. This qualified exemption will be available only to engines equipped with retrofit devices under a state or local program before 2017. The owner/operator must request the exemption prior to a remanufacturing event that would otherwise trigger the requirement to use a certified remanufacture system. The request must include documentation that the vessel has been retrofit pursuant to a state or local retrofit program and a signed statement declaring that to be true. Except for the initial request for a specific vessel and a specific retrofit, a request would be considered to be approved unless we notify the requestor otherwise within 30 days of the date that we receive the request. Note that the exemption does not apply where the sponsoring government specifies that inclusion in the retrofit program is not intended to provide an exemption from the requirements of this subpart. Owner/operators would be required to continue the use and maintenance of the retrofit kit that provides the basis for the exemption. Owner/operators that fail to operate or maintain the retrofit would be subject to the same penalties as would apply for malmaintenance of a certified engine's emission controls.

Beginning in 2017, this exemption will no longer be available for new retrofits. Engines included in state or local retrofit programs will be required to use a certified remanufacture system if one is available when the engine is remanufactured. In this case either the certified remanufacture system would be part of the retrofit or the vessel owner would use a certified remanufacture system at the next remanufacture event.

9.8 Definition of Remanufacture

Background:

As explained in the proposal, we designed the marine remanufacture program based on the locomotive remanufacture program. In the locomotive program, remanufactured was defined as meaning (i) to replace, or inspect and qualify each and every power assembly of a locomotive or locomotive engine, whether during a single maintenance event or cumulatively within a five-year period; or (ii) to upgrade a locomotive or locomotive engine; or (iii) to convert a locomotive or locomotive engine to enable it to operate using a fuel other than it was originally manufactured to use; or (iv) to install a remanufactured engine or a freshly manufactured engine into a previously used locomotive. Any of these events would result in a locomotive that is essentially new. Because large marine diesel engines installed on certain types of commercial marine vessels, including tugs, towboats, ferries, crewboats, and supply boats often undergo similar procedures, we indicated that it is appropriate to apply remanufacture requirements to those engines.

What Commenters Said:

AWO and Crowley called EPA's attention to the difference between "remanufacturing," as it is commonly understood in the industry, and "overhauling." AWO noted that engines on tugboats and towboats are not routinely "remanufactured"; instead, these engines undergo routine overhauls according to the manufacturer's recommendations. An overhaul is generally performed while the engine is still in the vessel and includes a complete engine teardown, thorough inspection and qualification of components, and reinstallation of new or requalified components. Overhauls are meant to restore an engine to the performance level it had when new; they are not meant to change the characteristics of an engine. "Remanufacturing," on the other hand, is a more comprehensive process that is typically conducted at a remanufacturing facility, and involves removing the engine from the vessel, reboring the engine block, and replacing all major components with the latest technology appropriate. This is performed when the engine is 25 to 30 years old, and has not been common in the tugboat, towboat, and barge industry.

The Port of Seattle recommended that the definition of remanufacture be stringent enough to assure older engines are addressed in a reasonable time frame.

Industry groups recommended that the definition of remanufacture should exclude repairs made to respond to emergencies as well as routine maintenance and minor overhauls.

Some commenters noted that EPA did not provide a regulatory definition of remanufacture for marine engines.

<u>Letters:</u>
American Waterways Operators (AWO) OAR-2003-0190-0574, 725
Caterpillar OAR-2003-0190-0591
Crowley Maritime Corporation (Crowley) OAR-2003-0190-0641, 659
Engine Manufacturers Association (EMA) OAR-2003-0190-0545 (hearing), 0575.1
Kirby Corporation OAR-2003-0190-0563.1
Lake Carriers Association (LCA) OAR-2003-0190-0567.1
Marathon Petroleum Company LLC OAR-2003-0190-0595.1
Port of Seattle OAR-2003-0190-0469.1

Our Response:

In the regulations we made available in the docket on September 10, 2007, we proposed that "remanufacture" means to replace every cylinder liner in an engine, whether during a single maintenance event or cumulatively within a five-year period. That is the approach we are finalizing for commercial engines over 600 kW. As described in section 9.7, definition of "remanufacture" excludes engines less than 600 kW and recreational engines from the program.

A remanufacture event is intended to cover rebuilding the engine in such a way as to make it like-new, and an engine that has undergone this process is intended to last as long as and operate in the same manner as a new engine. Therefore, it is necessary to identify a characteristic of a major rebuild that could be used to categorize the action as remanufacturing and that would exclude routine maintenance or other actions that do less than make the engine like-new.

In discussions with manufacturers and user groups, we determined that it was inappropriate to use the identical locomotive definition for "remanufacture" since although the concept is the same for both locomotive and marine with thorough rebuilds periodically performed on the engines, the specific parts that may be removed and replaced or requalified may be different. Specifically, replacement of power assemblies is an inappropriate trigger for some marine engines since power assemblies may not always be replaced as a complete unit. Instead, different components may be replaced. We also determined that it was inappropriate to use the common industry understanding of the term "remanufacture," which involves removing the engine and having the work done at a remanufacturing facility.

The approach we are adopting draws on certain features of large marine diesel engines used in commercial engines. As noted by AWO, it is difficult to remove the main propulsion engines from most commercial vessels, and therefore they are not removed from the vessel for maintenance. Further, the location of the main propulsion engines as well as their fuel and control systems is important both in terms of the stability of the vessel and in terms of vessel operation. As a result, the engines are designed to last the life of the vessel, which can be upwards of 30 years. This also means that the engine must be designed to be serviced on the vessel, since removal of major components such as cylinder blocks or crankshafts would often mean cutting into the hull of the vessel. The engines are designed for easy in-situ repairs so that those parts subject to wear can be replaced without difficulty, to minimize the time that the unit is out of service for repair or rebuild. This includes power assemblies, which consists of the pistons, piston rings, cylinder liners, fuel injectors and controls, fuel injection pump(s) and controls, and valves. The power assemblies are generally rebuilt to bring them back to as-new specifications, or they can be upgraded to incorporate the latest design configuration for that engine. As part of the routine rebuilding process, many types of power assemblies and key engine components can be disassembled and replaced or requalified (i.e., determined to be within original manufacturing tolerances).

Because there are differences among manufacturers with respect to instructions for replacing power assembly components, we determined that the replacement of cylinder liners, either all at once or over a period of five years, would indicate that the engine had undergone a rebuild intended to return it to as-new condition. Engine manufacturers indicated that replacement of cylinder liners is something common to what AWO described in its comments as a major overhaul and would therefore be a key component of returning an engine to as-new condition. This also avoids having routine maintenance or emergency repairs triggering the requirements.

The five-year period is identical to the approach in the locomotive remanufacture program. This has two effects. First, it allows owners to continue constant maintenance practices (also called "rolling rebuilds") whereby a fraction of an engine's cylinders are replaced every year. Some operators prefer this practice because it ensures constant power availability over the entire life of the engine instead of declining power over the period between overhauls. These owners can either use a certified remanufacture system as the cylinders are remanufactured, or replace all cylinders with certified remanufactured systems all at once at the end of the cycle, in the case of incompatibility between certified systems and the pre-existing cylinders. Second, it is a disincentive for owners to try to evade the requirements by avoiding replacing all cylinders at once.

This approach answers AWO's comment about the difference between overhauling and remanufacturing, in that we have defined the requirement in terms of what is being replaced and not where (i.e., on board or at a remanufacturing facility) or how much. An engine that has all cylinders liners replaced, either on the vessel or at a remanufacturing facility, would fall under the program. It will also ensure coverage of the affected vessels in a minimal amount of time, since most vessels replace all liners at once to avoid downtime.

9.9 Effective Date and Availability of Remanufacture Systems

Background:

Our proposal discussed a two-part program, with a first phase to begin as early as 2008 and a second, mandatory phase to begin as early as 2013. In the first phase of the program, a vessel owner/operator would be required to use a certified remanufacture system when remanufacturing a covered marine diesel engine if such a system has been certified. If no system has been certified, there is no requirement. In the second phase of the program, an owner/operator would be required to achieve a 25 percent reduction in PM emissions, either through the use of a certified remanufacture system or, if such a system is not available, by retrofitting a control device or by repowering.

What Commenters Said:

Many of the comments we received from state and local governments and environmental groups recommended earlier start dates for the mandatory program, ranging from to 2008 from 2010.

Industry commenters opposed the mandatory program (see 9.3, above). They also requested a later effective date for the voluntary program, and noted that the effective date should provide ample opportunity for implementation to ensure the technology is available to meet the regulatory obligation, to ensure the availability of remanufacture systems, and to ensure that industry members are aware of the requirements. Many recommended that the program start no earlier than 12 months after publication of the final rule, and the requirements be triggered at the first remanufacture after that date. At least one manufacturer noted that the Phase 1 program should begin no earlier than 2010 to allow manufacturers time to prepare remanufacture systems; if an earlier effective date is chosen, kits may not be robust.

With regard to owners who do not replace all cylinder liners at once, one commenter suggested that the requirements be triggered at the time the last power assembly is renewed after the effective date of the rulemaking.

At least one commenter requested that we add a provision that would allow a vessel owner to use non-certified parts if a certified remanufacture system is not available. This commenter noted that a vessel owner should not be required to tie up a vessel to wait for parts that are not available in a timely manner.

Letters:
American Waterways Operators (AWO) OAR-2003-0190-0574, 0725
California Air Resources Board (CARB) OAR-2003-0190-0596.1, 0719
Caterpillar OAR-2003-0190-0591
City of Houston (Texas) Bureau of Air Quality Control (BAQC) OAR-2003-0190-0561.1
Clean Air Task Force (CATF) OAR-2003-0190-0499 (hearing)
Clean Air Watch OAR-2003-0190-0500 (hearing)
Cummins Inc. OAR-2003-0190-0559, 731
Environmental Defense OAR-2003-0190-0592.1
Kirby Corporation OAR-2003-0190-0563.1
Lake Carriers' Association (LCA) OAR-2003-0190-0567.1
Marathon Petroleum Company LLC (Marathon) OAR-2003-0190-0595
Missouri Department of Natural Resources, Air Pollution Control Program (MDNR) OAR-2003-0190-0658
National Association of Clean Air Agencies (NACAA) OAR-2003-0190-0495 (hearing)
Natural Resources Defense Council (NRDC) OAR-2003-0190-0489 (hearing)
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0551.1
Ozone Transport Commission (OTC)OAR-2003-0190-0633
People for Puget Sound OAR-2003-0190-0649
Port of Seattle OAR-2003-0190-0469.1
Private Citizens (*various*)
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0558.1

Our Response:

See response to 9.3. The program we are finalizing consists only of the Phase 1 program that will begin as soon as the rule goes into effect; we are not pulling ahead the Phase 2 program.

As explained in our response to 9.3, this decision is in response to industry concerns over the costs of retrofitting emission control systems or repowering if a remanufacture system is not available. We intend to monitor implementation of the marine remanufacture program and will review the program as early as 2012 to determine if revisions are needed to obtain the emission reductions anticipated by this program. As part of that assessment, we will revise the program if remanufacture systems are not made available. Any change to the program will be the subject of a full rulemaking.

The marine remanufacture program could begin as soon as this rule goes into effect in the spring of 2008, when manufacturers may begin certifying marine remanufacture systems. It should be noted that the remanufacture requirement is not triggered until an engine is remanufactured and a certified remanufacture system is available for that engine. A remanufacture system will be considered to be available 120 days after we issue a certificate of conformity for it or 90 days after it has been included on EPA's list of certified systems, whichever is later. The earliest time by which a system could be certified and be considered to be "available" is in the fall of 2008, assuming that a manufacturer certifies a system in the spring. In addition, availability means not only that a system has been certified, but also that it can be obtained and installed in a timely manner consistent with normal business practices. For example, a system would generally not be considered to be available if it required that the engine be removed from the vessel and shipped to a factory to be remanufactured unless that is the normal rebuild process for that engine. Similarly, a system would not be considered to be available if the component parts are not available for purchase in the period normally associated with a scheduled rebuild. If a certified system is not available there is no requirement to comply with this program until the next remanufacture, at which time this availability determination will again be made.

The above provisions make it unnecessary to postpone the beginning of the program to 2009, 2010, or later.

An owner may use non-certified parts if a certified remanufacture system is not available, since no remanufacture requirement is triggered if there is no certified system or if the component parts of a certified system are unavailable. It should be noted that owners should keep a record of their efforts to obtain a certified system after one has been certified, in the case of a compliance action, to demonstrate an effort was made to locate the necessary certified system components.

For those cases in which cylinder liners are not replaced all at once (rolling rebuilds), the remanufacture requirement is triggered at the time the remanufacture system becomes available. Any remanufacturing that occurs after the system is available needs to use the certified system. However, if the components of a certified remanufacture system are not compatible with the engine's current configuration (i.e., if the engine cannot operate with a mix of new and old components), the program allows the owner to postpone the installation of the remanufacture system until the replacement of the last set of cylinder-liners, which would occur no later than five years after the availability of the system. At that time, the entire engine must be remanufactured using a certified remanufacture system or systems.

9.10 Remanufacture Standards

Background:

The standards described in the proposal would require certified marine remanufacture systems to meet at least a 25 percent reduction in PM emissions compared to the baseline engine emissions. This would be established based on emissions testing.

What Commenters Said:

Many of the comments we received from state and local governments and environmental groups urged us to adopt tighter standards, ranging from the new locomotive remanufacture standards to standards that reflect modern pollution control equipment that can achieve 40 to 50 percent reductions, for both NOx and PM. Some commenters noted that SCR and DOC systems have been successfully retrofit on existing engines, and one commented that emission reduction technologies such as emulsified fuel, water injection, and exhaust gas recirculation are individually capable of achieving at least 25 percent reduction. In addition, based on a number of Carl Moyer projects, repowering can also achieve about 50 percent reduction. Another commenter suggested that the standard require best available technology at the time of the rebuild, since new and cleaner options will develop through time. Other commenters said that emissions from remanufactured marine engines should be reduced so as to be similar to those expected from new engines under the proposed standards. These commenters noted that tighter standards would permit additional emission reductions to be realized in a much shorter time frame than waiting for older engines to be retired from use.

Industry commenters supportive of a program applicable to Category 2 engines only supported applying the new locomotive remanufacture standards to Category 2 engines when they are remanufactured. Other industry commenters were supportive of a 25 percent reduction described in the Notice of Proposed Rulemaking (NPRM). At least one commenter was opposed to applying the Tier 4 standards to rebuild, retrofit, or repower engines, and recommended that the rebuild requirements be limited to the best available technology that will fit in the current engine room. In its supplemental comments, EMA suggested that the program apply only to Category 2 engines and not require the use of a remanufacture system if an engine is within 135 percent of the Tier 2 PM standard.

EMD recommended that a provision be added allowing certification of remanufactured engines upgraded to meet specific freshly manufactured engine standards, regardless of the emissions reduction to be gained by the installation of the remanufacture system. Such a provision should allow the certification of a remanufactured engine simply by making its hardware and, where applicable, control software identical to those of the freshly manufactured configuration.

AWO and Kirby recommended a 2-part program similar to the locomotive remanufacture program. The first phase of the program could begin 12 months after publication of the rule and could require the use of a certified remanufacture system that meets the locomotive Tier 0 standards; the second phase could be based on the new locomotive Tier 0 and Tier 1 standards. EMA recommended that the program apply only to engines that are at least 15 years old and are above 600 kW, and the standards should not require aftertreatment. EMD said the standards should reflect reductions that can reasonably be expected for older engines, such that deep reductions would not be required of older engines due to the limits of applying more recent emission control technologies to those engines. In its supplemental comments, EMD also requested that EPA take into account the NOx reductions associated with the locomotive Tier 0 standards when considering the final marine remanufacture standards. The commenter noted that it has been certifying remanufacture systems for locomotives for many years based on a requirement that required reducing NOx with no PM increase. The commenter recommended that these systems be permitted until an alternative system is certified that achieves a PM reduction

PVA indicated that it opposes a stepped approach that would entail standards based on reductions of 60 percent, 40 percent, and 20 percent, and requiring that a rebuild use the certified kit meeting the most stringent of these three standards if available.

<u>Letters:</u>
American Waterways Operators (AWO) OAR-2003-0190-0574.1
California Air Resources Board (CARB) OAR-2003-0190-0596.1
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0591.1
City of Houston (Texas) Bureau of Air Quality Control (BAQC) OAR-2003-0190-0561.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502 (hearing), 0594, 729
Engine Manufacturers Association (EMA) OAR-2003-0190-0545 (hearing), 0575.1
Kirby Corporation OAR-2003-0190-0563.1
Marathon Petroleum Company LLC OAR-2003-0190-0595.1
Missouri Department of Natural Resources, Air Pollution Control Program (MDNR) OAR-2003-0190-0658
National Association of Clean Air Agencies (NACAA) OAR-2003-0190-0495 (hearing)
Oregon Department of Environmental Quality, Air Quality Division OAR-2003-0190-0506, 0652
Passenger Vessel Association (PVA) OAR-2003-0190-0576.1
Port of Seattle OAR-2003-0190-0469.1
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0558.1

Our Response:

The standard we are adopting for marine remanufacture systems is a 25 percent reduction in measured PM emissions and no increase in NOx emissions (within 5 percent). This standard is similar to the PM emission reduction that was achieved from our Tier 2 marine diesel standards for new engines. This standard reflects reductions that can be achieved through improvements to piston ring-pack designs, as well as turbocharger, fuel system, and closed crankcase ventilation system improvements, and will not require the use of exhaust aftertreatment devices. While there may be technologies that can reduce PM further, it is not clear that such technologies can be applied to all existing engines built in 1973 and later. By adopting a more stringent standard, the program may exclude engines that could achieve emission reductions if a less stringent standard were adopted. In addition, the technologies that were used to achieve the Tier 2 standards can be applied to engines with similar platforms as the Tier 2 engines and may be more readily adaptable to older engines.

We do not agree with the suggestion that the program not apply to engines that are already within 135 percent of the Tier 2 PM standard. The technologies that can be applied to control PM emissions from marine diesel engines, including improvements to piston ring-pack designs, as well as turbocharger, fuel system, and closed crankcase ventilation system improvements. These engine-based technologies can achieve the 25 percent PM reduction required in this program without the use of exhaust aftertreatment devices. If it is not possible to achieve a 25 percent reduction in PM from an existing model of engines, then a system will not be certified; it is not necessary to exempt these engines from a voluntary program such as the one we are finalizing. In addition, this type of exemption would be complicated to administer, since it would be necessary to provide emission testing to show that the engine's PM emissions fall within that 135 percent range. Finally, we are concerned that the PM emission reduction for at least some existing engines will already be within 135 percent of the Tier 2 PM standard due to the new controls on marine diesel fuel that reduces the sulfur content from the 2,000 ppm limit on which the engines were originally certified to 500 ppm in 2007 and 15 ppm in 2012.

We intend to monitor implementation of the marine remanufacture program and will review the program as early as 2012 to determine if revisions are needed to obtain the emission reductions anticipated by this program. As part of that assessment, we will consider if it is appropriate to set additional more stringent standards, similar to the tightening of the locomotive marine standards included in the final rule. Any change to the program will be the subject of a full rulemaking.

With regard to EMD's comment about allowing existing locomotive Tier 0 kits to be used in this program, we agree with EMD's assertion that those systems, while not providing a PM benefit, will provide important NOx reductions. Therefore, the final program allows locomotive Tier 0 systems to be certified as marine remanufacture systems. However, those systems can be used only on pre-Tier 1 (uncertified) Category 2 engines, and the use of these existing Tier 0 systems will not be permitted after systems certified to the new Tier 0 locomotive standards are made available.

With regard to the stepped approach, we are not adopting that requirement. In conversations with manufacturers, many expressed concern that such a requirement would discourage the development of remanufacture systems since they could rapidly become obsolete. In addition, owners were concerned that they would be subject to a moving requirement that would complicate their engine maintenance and overhaul schedules and could result in identical engine models being required to use different remanufacture systems. They also wondered whether such an approach would mean they would have to use a different system every time they remanufacture, and the impacts on engines that are remanufactured over several maintenance events. For these reasons, instead of adopting the multi-step approach, we are adopting a single emission reduction requirement. If several certified systems are available, we will allow any of them to be used. However, states may develop incentive programs to encourage the use of the certified remanufacture system with the greatest reduction. Also, we may revisit the emission level in the future to determine if it should be modified to reflect advances in applying new PM reduction technologies to existing marine diesel engines.

Finally, with regard to EMD's suggestion that manufacturers be allowed to certify remanufacture systems based solely on applying the same hardware and control systems that are being used to achieve the freshly-manufactured engine standards, we are not adopting such a provision. While such a program could result in greater emission reductions, we are concerned that shortcutting the certification process risks certifying remanufacture systems that are too burdensome to vessel owner/operators. Specifically, these greater emission reductions could come at much greater costs, and this will not be well known absent complying with the certification requirements and demonstrating that the remanufacture system costs less than $45,000 per ton of PM reduced. Also, because the requirement to use a remanufacture system is triggered once such a system is certified, it is important to ensure that the systems are reliable and durable. It should be noted, however, that engine manufacturers who wish to provide these retrofit systems can do so through EPA's diesel retrofit program.

9.11 Certification of Remanufacture Systems

What Commenters Said:

Several commenters asked for more information about how remanufacture systems would be certified. EMA and Cummins expressed concerns about third-party companies certifying remanufacture systems and the impacts of those systems on engine durability and reliability. EMD requested simplified certification for locomotive remanufacture systems that can be used on marine diesel.

In supplemental comments in response to the proposed regulations that were made available on September 10, 2007, EMA expressed concern about "will-fitters" who may enter the rebuilt market with potentially substandard rebuild kits (not made from the original engine manufacturer's approved parts) that could negatively impact the durability and performance of the underlying marine engine. EMA also suggested that remanufacture systems be subject to a notice and comment period similar to that for the urban bus rebuild program. Cummins also noted in supplemental comments that it has spent millions of dollars designing engines with high levels of reliability and durability, and that it is unlikely that any third party would be able to adequately demonstrate the existence of no adverse effects on an engine's reliability or durability. The commenter noted that issues could be something as simple as increased exhaust back pressure or as complex as incompatibility between an engine's electronic calibration and aftertreatment regeneration. Cummins was also concerned about the investment it would take to either issue disclaimers about third-party kits or disprove the kit developer's claims.

EMA also suggested streamlined certification for Tier 1 upgrade kits if it can be shown that such kits yield PM reductions of 25 percent or more from a measured baseline.

EMD noted that in addition to achieving a 25 percent PM reduction, NOx emissions for remanufacture systems must be equivalent or less than the baseline NOx levels for the engine. The commenter recommended that NOx emissions five percent greater than those of the baseline configuration be accepted as equivalent.

Letters
American Waterways Operators (AWO) OAR-2003-0190-0574, 725
Cummins Inc. OAR-2003-0190-0559, 731
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502, 0594, 0729
Engine Manufacturers Association (EMA) OAR-2003-0190-0545 (hearing), 0575, 726

Our Response:

In general, the normal certification requirements for new marine diesel engines would apply, with minor variations as needed to accommodate the characteristics of remanufactured engines. For example, engine families are based on the same criteria as freshly manufactured engines, and testing, reporting, the application for certification, and warranty requirements closely follow the provisions that apply for freshly manufactured engines. To certify a remanufacture system, a manufacturer must measure baseline emissions and emissions from an engine remanufactured using its system. A baseline emission rate would be established by remanufacturing an engine following normal procedures. That engine, or a second engine of the same configuration, is then tested for emissions after remanufacturing with the expected emission controls. The remanufacturing system meets the emission standards of the program by demonstrating a minimum 25 percent reduction in PM emissions and no increase in NOx emissions (within 5 percent). The remanufacturer must also demonstrate that the remanufacturing system does not adversely affect engine reliability or power.

The regulations allow for simplified certification requirements for remanufacture systems that are already certified under the locomotive program. This would require only an engineering analysis demonstrating that the system would achieve emission reductions from marine engines similar to those from locomotives. Because the marine remanufacture program requires only a PM reduction, locomotive remanufacture system manufacturers may modify those locomotive systems with respect to NOx emissions. In that case, the system will have to be recertified as a marine remanufacture system based on measured values and subject to all of the other certification requirements of the marine remanufacture program

We are not providing a similar streamlined certification for Tier 1 upgrade kits. The locomotive streamlined certification is reasonable because the underlying system, the existing locomotive Tier 0 system or the future Tier 0, 1, or 2 systems, are certified under the locomotive program. Tier 1 upgrade kits, on the other hand, are not pre-certified under another program.

Some engine manufacturers expressed concern about the potential for unintended adverse effects on engine performance, reliability, or durability that could occur if another entity develops a remanufacture system for their engines. They were particularly concerned about being held responsible for an emission failure if the remanufacture system does not perform as intended, or for an engine failure if the system causes other engine components to fail. While we agree that engine manufacturers need to be made aware if a third party certifies a remanufacture system for one of its engines, we do not agree that the way to do this is through a public notice and comment approach. Such an approach would be burdensome, both for the industry and engine manufacturers, given the large number of engine models that could potentially be affected by the program. Instead, to address this concern about third-party "will-fitters," the program we are finalizing requires any person who wishes to certify a remanufacture system for an engine not produced by that person to notify the original engine manufacturer and request their comments on the remanufacture system. Any comments received by the certifier are required to be included in the certification application, as well as a description of how those comments were addressed.

With regard to EMD's comment about NOx emission limits, we have adopted their suggestion. The remanufacturing system meets the emission standards of the program by demonstrating a minimum 25 percent reduction in measured PM emissions and no increase in NOx emissions (within 5 percent).

9.12 Technology Review

Background:

We asked for comment on the need for a technology review for the marine remanufacture program prior to implementation of the mandatory second phase of the program. This review could take place in 2011.

What Commenters Said:

Industry commenters were supportive of a technology review in 2011. Such a comprehensive technology review would be useful to take stock of what rebuild kits are available for which marine engines, and to assess the overall cost-effectiveness of any mandatory marine engine rebuilds. This would also ensure that the standards are attainable with current technology.

Letters:
American Waterways Operators (AWO) OAR-2003-0190-0574.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0545 (hearing), 0575.1
Lake Carriers' Association (LCA) OAR-2003-0190-0567.1

Our Response:

Since we are not adopting a mandatory second phase, a technology review for that program is unnecessary. In addition, given the level of the marine remanufacture program standards and the technologies that will be used to achieve them we do not believe a technology review is necessary for this program. However, we are committed to the development and successful operation of a marine remanufacture program. We intend to assess the effectiveness of this program as early as 2012 to ascertain the extent to which engine manufacturers are providing certified remanufacture systems. If remanufacture systems are not available or are not in the process of being developed and certified at that time for a significant number of engines, we may consider changes to the program. In evaluating the effectiveness of the remanufacture program in the future, we may revisit the need for Part 2, or something similar, to ensure emission reductions from the large marine legacy fleet are occurring in a timely and effective manner. We may also evaluate other aspects of the program, including the criteria that trigger a remanufacturing event (including the 5-year period for incremental remanufactures), and whether the program should also apply to engines less than 600 kW. Revisions, if necessary, will be pursued in a separate rulemaking.

9.13 Costs

What Commenters Said:

We received comments from industry groups who were concerned about the costs of a mandatory marine remanufacture requirement such as the one contained in Phase 2. For example, the Washington State Department of Transportation (WSDOT) and Washington State Ferry System (WSF) noted that the initial estimate of the cost to meet Tier 2, 3, and 4 standards throughout the WSF ferry fleet is $35-$55M (in 2007 dollars). The commenters noted that it is very costly to remove propulsion engines from vessels for remanufacture, and removal and reinstallation processes will also significantly impact the availability of ferries for operational service. The commenters stated that they believe that a concept of a certified retrofit kit approach for achieving the PM and NOx targets would be more cost efficient. The WSDOT/WSF comments also contained extensive details of their preliminary research into the impacts to WSDOT/WSF resulting from the proposed rule.

The Makah Tribal Council commented that there is no definitive information or projections on what it would cost to retrofit older remanufactured or rebuild engines. The commenter noted that increased costs could put an unfair economic burden on commercial fisherman with smaller boats (both tribal and nontribal) in an economic environment that is already hostile to the small commercial fisherman. The commenter requested that more information and data be provided on the possible costs for this type of retrofit.

The Lake Carriers' Association stated that it believes that if the cost of a new or rebuilt power plant is so high that it cannot be justified by freight rates and long-term market projections, a modal shift is inevitable. The commenter noted that its members have relayed that current freight rates are at best equal to the early 1990s in terms of real dollars (thus, the commenter stated, this is not an industry awash in spare cash). The commenter stated that is does recognize the need to protect the environment, and noted that LCA members do take steps to enhance the performance of' their vessels. However, the commenter noted, decisions to upgrade or repower have to be based on economic realities—the commenter noted that the costs of replacing an engine are significant and difficult to justify in the current market.

<u>Letters:</u>
Lake Carriers' Association (LCA) OAR-2003-0190-0567.1
Makah Tribal Council OAR-2003-0190-0472
Washington State Department of Transportation (WSDOT)/Washington State Ferry System (WSF) OAR-2003-0190-0555.2

Our Response:

See answer to 9.3. We are not finalizing the mandatory Phase 2 program. We expect the costs associated with certified remanufacture systems that achieve a 25 percent reduction in PM will be reasonable given that manufacturers already have experience with the applicable technologies that were applied to meet the Tier 2 PM limits. In addition, we have put a cost cap of $45,000 per ton PM reduced to discourage certification of kits that would require aftertreatment or other costly solutions.

With regard to the WSDOT/WSF comments regarding the costs associated with the possible marine remanufacturing program, we do not believe that the costs developed by the commenter are applicable to the program being finalized. Those costs appear to consider the costs associated with both phases one and two that were presented in the proposed rule, and appear to assume that vessel owners will be required to comply with the new engine Tier 3 and Tier 4 standards. The marine remanufacture program we are finalizing for existing engines only requires that, at the time of remanufacture, the owner use a certified remanufacture system that achieves at least a 25 percent reduction in PM emissions compared to baseline if such a system has been certified for the relevant engine; if no system has been certified, there is no requirement. Remanufacture systems are expected to be made up of improved versions of the same parts that are replaced in a thorough overhaul of the engine, and there would be no need to take a vessel out-of-service any earlier than would be done under current operating plans (i.e., when the engine would normally be remanufactured, defined as replacing all of the cylinder liners either all at once or over a 5-year period). While it is true that the final requirement would require that vessels be out-of-service for the time required to undergo the remanufacturing process, that out-of-service time period is not expected to be any longer than under current practices since the replacement of engine parts is expected to be the same.[3] Therefore, we are not requiring any incremental increase in the amount of out-of-service time. Note that the new certified remanufacture kits are expected to be more costly than kits that could be used absent this requirement and we have accounted for that incremental cost in our marine remanufacturing cost estimate. Finally, remanufacture systems are not expected to require the use of aftertreatment control technology, since the 25 percent PM reduction can be achieved with engine based controls such as changes to piston ring-pack designs, as well as turbocharger, fuel system, and closed crankcase ventilation system improvements.

9.14 Technology Constraints

What Commenters Said:

Several commenters raised questions about the ability of existing engines to use PM emission reduction technologies. Many of these commenters requested that, in considering a marine remanufacture program, EPA take into account the unique operational environment as well as technological availability and feasibility of implementing land based emission reduction technologies within the marine environment. These commenters noted that there are significant challenges in developing a remanufacture provision for the existing marine diesel engine market. Other commenters expressed concern about the wide variety of existing engine manufacturers within the Category 1 fleet of engines and that there is no retrofit technology or approved emission reduction certified kit in production for Category 1 engines. In addition, there is little or no emissions data (especially for PM) available for most of the existing marine engines, and in some cases the original engine manufacturer may not be in business anymore. For all of these reasons, a program like Phase 2 that mandates an emission reduction from existing engines by a given date may not be feasible.

GE commented that it believes that, in general, the technology and opportunity to apply emissions improvements to marine engines at the time of remanufacture is equivalent to that for locomotives. The commenter noted that there are several upgrades that can be done without changing the footprint of the engine and without significantly affecting other systems on the vessel, such as vehicle control and cooling. The commenter further stated that some of the available technologies that could be applied are turbo optimization, combustion optimization, fuel system upgrades, and injection timing optimization. GE commented that it believes that the application of these technologies would result in exhaust emissions reductions equivalent to what is specified for remanufactured locomotive engines in Part 1033 of the proposed rule. GE also commented that, while there may be some engine families or engine models that are small in number or so unique that it may not be economical or practical to expect an emissions upgrade kit to be developed, it recommends that EPA make application of an upgrade kit mandatory at

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3 An exception would be if an owner who normally does a rolling rebuild elects to replace all cylinder liners at once, in which case the engine may be out of service somewhat longer; this would be offset by not taking the engine out of service annually for partial rebuild events.

the time of remanufacture if a certified kit is available.

Letters:
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502 (hearing), 0594.1, 0729
Engine Manufacturers Association (EMA) OAR-2003-0190-0545 (hearing), 0575.1
General Electric Transportation (GE) OAR-2003-0190-0590
Kirby Corporation OAR-2003-0190-0563.1
Lake Carriers' Association (LCA) OAR-2003-0190-0567.1
Marathon Petroleum Company LLC OAR-2003-0190-0595.1
Offshore Marine Service Association (OMSA) OAR-2003-0190-0490 (hearing)

Our Response:

We recognize the concern that several commenters expressed about a mandatory engine remanufacturing program for engines with power ratings greater than 600 kW. However, as expressed by GE in its comments, many of the control approaches that are used in locomotive remanufacture systems are expected to be applicable to marine applications. Concern about the ability to transfer these technologies is addressed by our adoption of only the first phase of the program described in the NPRM. Participation in the program is mandatory only when a verified rebuild system is available – if no system is available, there is no requirement for the vessel owners to deviate from their traditional rebuild practice. We expect that there will be a small number of engine models where it is not economically feasible to develop, test, and certify a PM-reducing technology. However, we expect that engine manufacturers and/or rebuilders will develop, certify, and distribute the technologies needed to achieve a 25% PM reduction on high-sales volume engines.

In the case of 2-stroke marine engines which are based on locomotive designs, a PM solution already exists in the form of low-oil-consumption power assemblies. Once the PM levels for these power assemblies have been tested and verified on the marine test cycles, they will be eligible for use in this program.

9.15 Flexibilities

What Commenters Said:

We received several suggestions for flexibility provisions to include in the final marine remanufacture program. These include: an alternative compliance mechanism that would allow greater PM reductions to compensate for lower NOx reductions; allowing fuel additives to be certified as remanufacture systems; allowing a fleet averaging approach, that would allow fleet owners to develop an efficient and more cost-effective method of managing emissions; including a small business exemption; providing financial incentives or tax credits to encourage owners to replace older engines; and including an exemption or waiver process for vessels that will be scrapped or permanently removed from service in the U.S. market within a specified period of time.

Letters:
American Waterways Operators (AWO) OAR-2003-0190-0574.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502 (hearing), 0594.1, 0729
Lake Carriers' Association (LCA) OAR-2003-0190-0567.1
Marathon Petroleum Company LLC OAR-2003-0190-0595.1

Our Response:

We have included several flexibility provisions to reduce the burden of the marine remanufacture program. The final program will allow fuel and fuel additives to be certified as remanufacture systems as long as they meet certain requirements. We also included a small business exemption (see Chapter 7 of this Summary and Analysis of Comments document).

With regard to the comment about including a waiver process for vessels that are expected to be scrapped or permanently removed from service we do not think such a waiver is necessary. If an owner intends to scrap a vessel, it is unlikely that the owner will remanufacture the engines on that vessel. If the engines are remanufactured, then the owner obviously intends to use it in the meantime, in which case it is appropriate for the engines to comply with the remanufacture program if they are remanufactured.

We have not included a provision that would allow greater PM emissions to compensate for lower NOx reductions. This provision is not necessary since the standard is for PM only. We have also not included a provision for fleet averaging. This is not necessary because we are not adopting the mandatory Phase 2 program. Since the requirement is linked to the existence of a certified remanufacture system for a particular engine, it is not clear how an averaging program could be applied. Finally, the Clean Air Act does not allow EPA to extend financial incentives or tax credits as methods to encourage compliance with the program.

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10. TECHNOLOGICAL FEASIBILITY

What We Proposed:

The comments in this section relate to the technological feasibility of the standards described in Section III of the preamble to the proposed rule and Chapter 4 of the Draft Regulatory Impact Analysis (Draft RIA, or DRIA). Note that this chapter addresses only the specific comments we received. See Chapter 4 of the Final RIA for a more complete feasibility analysis.

10.1 Remanufactured Locomotive Standards

10.1.1 Lead-Time for Tier 2 Remanufactured Locomotive

What Commenters Said:

The Engine Manufacturers Association (EMA) commented that the requirement for Tier 2 locomotives originally manufactured between 2005 and 2012 to meet a modified Tier 2 particulate matter (PM) level of 0.1 grams per brake horsepower-hour (g/bhp-hr) when remanufactured effectively sets a standard without any lead time. The commenter raised the concern that customers for current-design Tier 2 engines will expect immediate answers for how the new Tier 2 standards will be met when their engines are remanufactured after 2013, and further that those expectations for compliance with the new Tier 2 standards will be occasioned by the Notice of Proposed Rulemaking (NPRM), even before the final rule is issued. EMA commented that before finalizing the Tier 2 standard for remanufactured locomotive engines, it believes that EPA must consider the lack of lead time associated with the standard and the potential impact on future sales of Tier 2 locomotive engines.

The Natural Resources Defense Council (NRDC) also commented that EPA should strengthen the program to clean up existing engines by requiring existing train engines to be cleaner when they are rebuilt, as soon as possible and no later than 2010 for any locomotive engine (versus waiting until 2013 to make the clean-up of all existing locomotive engines mandatory, as proposed in the NPRM). NRDC also cited Wall Street Journal comments made by EMD in which it stated that "…we're definitely intending to meet all of the [EPA] rules and requirements." NRDC commented that EMD's statement shows that the proposed standards and timetables are feasible.

<u>Letters:</u>
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1
Natural Resources Defense Council (NRDC) OAR-2003-0190-0489

Our Response:

We have set the Tier 2 locomotive remanufacturing standard, commented on here by EMA, and the new Tier 3 locomotive standard at the same level with the intent that both standards can be met using the same technology solutions (and concurrent technology development plans). Specifically, we project manufacturers will use incremental improvements to engine hardware to reduce oil consumption, possible changes in fuel system hardware or parameters to reduce soot formation, and other engine-out PM emission control technologies as described in chapter 4 of the Final RIA. Considering the incremental nature of these changes and the availability of ultra-low sulfur diesel fuel (ULSD) in 2012, there is sufficient lead time (at least five years) for manufacturers to develop Tier 2 remanufactured engine solutions to meet the new emission standards. Please refer to Chapter 4 of the RIA for a further description of the engine technologies that are expected to be used to meet the Tier 3 and remanufactured Tier 2 locomotive emission standards. NRDC called for acceleration of the Tier 2+ remanufactured engine standard, by as much as 3 years, but did not provide evidence that this would be feasible. Our own analysis, discussed in RIA section 4.2 and in the rulemaking preamble section III.C, leads us to conclude that a year of lead time after the 2012 Tier 3 start date is appropriate to adapt Tier 3 technologies to the Tier 2+ locomotive remanufacture systems, and that 2012 is the appropriate start date for Tier 3. Our early introduction provision requiring use of any Tier 2+ systems certified before 2013 provides incentive for early introduction without risking disruption of the long-term program from overly aggressive mandatory short-term objectives. We also note that very early certification of Tier 2+ systems, either on a mandatory or voluntary basis, would not likely have a large environmental impact because the Tier 2 fleet is still quite new and not likely to be coming due for first remanufactures for some time yet.

10.1.2 Stringency of Remanufactured Locomotive Standards

10.1.2.1 Tier 2 PM for Remanufactured Locomotive

What Commenters Said:

As discussed in Chapter 3 of this Summary and Analysis of Comments document, EMA commented that the proposed Tier 3 PM reductions represent a 50% reduction from the current Tier 2 locomotive PM standards while the relevant Tier 2/Tier 3 PM standard for nonroad engines is only a 35% reduction. The commenter stated that it believes that those proposed standards are too aggressive, since, among other things, they are substantially lower than the Tier 2 and Tier 3 nonroad PM standards. The commenter urged EPA to consider a less aggressive step in PM reduction over the current locomotive standard, and suggested that a 35% reduction is a more reasonable reduction for the Tier 2/Tier 3 PM standards, and is more in line with the nonroad engine PM emission standards.

<u>Letters:</u>

Engine Manufacturers Association (EMA)   OAR-2003-0190-0575.1

Our Response:

The commenter correctly notes that we have set a more stringent Tier 3 PM standard than the Tier 2/3 nonroad PM standard set almost ten years ago. The more stringent PM standard, a 50% reduction in PM emissions from the current locomotive Tier 2 standards to the new locomotive Tier 3 standards reflects the advanced state of diesel engine technology and reflects a technologically feasible and cost effective means of reducing PM emissions from locomotives. The commenter did not state that a 50% PM reduction was not feasible for locomotives. Further, nonroad generators over 560 kW have already been introduced with PM emissions certified under 0.10 g/bhp-hr on the 5-mode D2 test cycle (2007 Cummins engine family 7CEXL050.AAD at generator ratings of 1300 kW and 1500 kW).

10.1.2.2 Tier 2 PM for Remanufactured Switchers

What Commenters Said:

As discussed above in Chapter 3 of this Summary and Analysis of Comments document, EMA noted that the proposed Tier 2 PM standards for rebuilt engines and the proposed Tier 3 PM standards for new switcher applications are at the same level. The commenter noted that those proposed levels are a similarly aggressive 50% reduction when compared to the current Tier 2 switcher standard, and that the proposed Tier 2 PM rebuild standards and the Tier 3 PM standards for new switcher applications are not in harmony with the nonroad Tier 2 and Tier 3 PM standards, and so will require new engine development programs outside of the scope of what is in place for nonroad engines. The commenter suggested that, to avoid the unacceptable workload burden that would result for engine manufacturers, and to attain proper alignment with the nonroad engine standards, the Tier 2 switcher rebuild standard should be set at 0.15 g/hp-hr (0.20 g/kW-hr) instead of 0.13 g/hp-hr (0.17 g/kW-hr) PM, and the Tier 3 new switcher standard should be set at 0.15 g/hp-hr (0.20 g/kW-hr) instead of 0.10 g/hp-hr (0.13 g/kW-hr) PM. EMA commented that it believes that unless there is this type of harmonization of the PM standards, the otherwise slight differences in the two sets of PM standards will drive separate technologies or engine families, which is simply unacceptable for engine manufacturers. The commenter further stated that it believes that the impact on the proposed PM standards from the recommended harmonization is small, and it is still a greater percent reduction in PM emissions than what has been proposed for the line-haul application.

<u>Letters:</u>
Engine Manufacturers Association (EMA)   OAR-2003-0190-0575.1

Our Response:

National Railway Equipment Co. (NREC) and Railpower Technologies, two of the largest switch locomotive manufacturers, have already introduced low-emission switch locomotives based on nonroad Tier 2 and Tier 3 engine technology. NREC switch locomotives based on nonroad Tier 3 technology have been introduced in the U.S. with PM emissions of 0.06 g/bhp-hr over the locomotive switch cycle, already 40% below the 0.10 g/bhp-hr Tier 3 switch locomotive PM standard. The Railpower Technologies RP20BD switch locomotives introduced in January 2006 use Deutz 2015 Tier 3 nonroad engines certified over the nonroad 8-mode test cycle at less than 0.04 g/bhp-hr. We do not believe that the Tier 3 and remanufactured Tier 2 switch locomotive standards represent an undue workload burden on nonroad Tier 3 engine suppliers because of the current availability of engine families suitable for switch locomotive applications with PM emissions that are well below 50% of the Tier 3 nonroad standard. Such engines are already offered for switch locomotive applications and already have PM emissions consistent with a switch locomotive standard of 0.10 g/bhp-hr.

10.1.2.3 NOx Control for Older Tier 0 Locomotives

What Commenters Said:

Electro-Motive Diesel, Inc. (EMD) commented that it believes that the Tier 1 standards for Part 92 Tier 0 locomotives are feasible, but it is concerned that one type of separate-loop aftercooled locomotives may be subject to loss of power at high temperatures if the oxides of nitrogen (NOx) standard is not revised. EMD calculates that, even with cooling system modifications, the model will be forced to derate at ambient temperatures above approximately 95 °F and at the maximum design temperature of 115 degrees, traction horsepower will have fallen from the rated 4000 to approximately 3150. The commenter noted that these locomotives are critical to the coal-hauling fleet of at least one major railroad, thus such a power loss represents a major loss of value. Further, the commenter urged EPA to discuss the format of the new Tier 1 standards with stakeholders before the final rule is issued.

General Electric Transportation (GE) commented that more than 2000 of its Tier 0 locomotives which were built without split cooling systems cannot meet the proposed 8.0 g/bhp-hr NOx standard. GE further commented that these locomotives would require substantial cooling system and engine system upgrades to meet the standard, and that the cost of these changes would exceed the $125,000 limit for incremental hardware cost.

The Association of American Railroads (AAR) commented that it believes that the Tier 0 standards are infeasible for some engines. The commenter noted that GE informed EPA and AAR that the proposed Tier 0 standards for all GE locomotives cannot be met without a separate intake air coolant loop. The commenter stated that, in this respect, EPA's proposed rule is based on an assumption that is incorrect. The commenter cited the statement in the Notice of Proposed Rulemaking (NPRM) that for discussing locomotives built without a separate intake air coolant loop "[EPA's] analysis indicates that it is feasible to obtain a NOx reduction for them on the order of 15 percent, from the current Tier 0 line-haul NOx standard of 9.5 g/bhp-hr to the proposed 8.0 g/bhp-hr standard." The commenter noted that GE has stated that it cannot meet the 8.0 g/bhp-hr NOx standard or the 0.22 g/bhp-hr PM standard without a separate intake air coolant loop. AAR further noted that even retarded engine timing, ignoring the fuel and emissions impacts it would have, would not work because GE could not retard engine timing to the point where both the NOx and PM standards could be met. The commenter noted that it is generally agreed that retrofitting old locomotives with a separate intake air coolant loop is untenable, because the cost of remanufacturing would approach the value of the locomotive, making remanufacturing of these over twenty-year old locomotives uneconomical. AAR commented that it understands that, notwithstanding the approach set forth in the proposed rule, EPA intends to change the proposed rule so that retrofitting locomotives with a separate intake air coolant loop will not be required. The commenter urged EPA to make the railroads part of the discussion as to what standards would be appropriate for these locomotives due to the significant impact it could have on AAR members and the industry.

AAR also commented that it does not agree with the proposal to require all Tier 0 locomotives to be subject to more stringent emissions standards when remanufactured. The commenter noted that remanufacturing some of these older locomotives to more stringent standards might not be worth the expense, and as a result, railroads might continue to use these locomotives well past their regulatory useful lives, for as long as possible without remanufacturing, and then retire them upon failure. The commenter is concerned that these engines will not be moved to switch service or small railroad applications (as EPA posits), but rather the locomotives will continue to be used by Class I railroads to failure. (The commenter noted that the majority of the older Tier 0 engines in question are six-axle locomotives, which are ill suited for switch service and small railroad applications.) AAR thus stated that it believes that subjecting older Tier 0 locomotives to more stringent standards might be counterproductive from an environmental viewpoint; and that EPA should consider whether or not the environment will benefit from applying regulations to these locomotives that will provide an incentive to avoid remanufacturing to EPA standards.

Letters:
Association of American Railroads (AAR) OAR-2003-0190-0566.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
General Electric Transportation (GE) OAR-2003-0190-0590.1

Our Response:

We have undertaken a comprehensive model-by-model review of the existing post 1972 locomotive fleet to understand the issue raised here and to ensure that the remanufacturing standards that we are finalizing will 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 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. As the commenters note, some existing locomotive engines have inherent limitations set when they were first built, in some cases more than 30 years ago. We have therefore made specific changes to our proposed remanufacturing standards to ensure that the standards are achievable for these locomotives. In this case, we have defined some narrow emissions "carve outs" for a limited number of the existing locomotives that ensure we are achieving the maximum degree of emission reductions possible while reflecting the technological limitations of these existing locomotive designs. Please refer to 40 CFR 1033.655 for specific regulatory provisions regarding certain Tier 0/Tier 1 locomotives. This subject is also addressed in section 3.1.1.1.

10.2 Tier 3 and Tier 4 Locomotive Standards

10.2.1 Lead-Time for Tier 4 Locomotive Standards

What Commenters Said:

GE commented that, while it does not believe the 2017 compliance date should be accelerated, it believes that it is important to recognize that the environmental benefits of Tier 4 locomotives will be achieved for model years beginning in 2015 and that many locomotives will be operating in the Tier 4 configuration for test purposes well before the 2017 compliance date. (Note that GE also submitted a later supplemental comment stating that it would support a regulatory option in EPA's final rule that brought the Tier 4 NOx compliance date to 2015 provided the program included a significantly longer in-use add-on period to address their durability concerns).[1] The commenter suggested that it would be more technologically defensible for EPA to make the transition period consistent with the useful life of the locomotive (i.e., EPA should not impose the Tier 4 NOx standard until one useful life has passed after 2015). The commenter also suggested that EPA should also consider extending the number of model years for the deterioration add-ons for both Tier 4 NOx and particulate to cover a typical useful life period of seven model years.

GE also commented that it agrees that a phase-in period is needed given the significant technical challenges of installing NOx aftertreatment systems on locomotives. The commenter noted that the Manufacturers of Emission Controls Association's (MECA) testimony at the Chicago public hearing indicated that the control manufacturers only anticipate having their systems ready for introduction in 2015. The commenter stated that this means EPA has only provided two years for integration into the locomotive and testing on the rails, which it believes demonstrates that an earlier introduction date is not achievable. The commenter further stated that it believes that the 2015 date suggested by MECA really needs to be 2012 for aftertreatment technology to be commercially available on the locomotive in 2017. GE commented that, during the 2010 catalyst technology review, EPA should consider whether the catalyst will be available in a time frame that allows integration and testing; the commenter believes that accelerating the 2017 compliance date is neither possible nor responsible given the need for reliability of

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1 Email from Shannon Broome, General Electric, to Byron Bunker, U.S. EPA, Re: Supplemental Comment of General Electric - February 12, 2008

locomotives in service. The commenter noted that, manufacturers and railroads have told EPA before, reliability is paramount in railroad service. The commenter stated that, since NOx and PM aftertreatment is a major new technology application for locomotives, an intensive program of development and reliability demonstration, including two to three years of in-house development and a field test of at least two years, will be necessary before it is placed into full production.

EMD commented that, with regard to the staggered introduction of aftertreatment-forcing PM standards in 2015 and such NOx standards in 2017, it believes that EPA has properly phased-in aftertreatment on locomotives. The commenter noted that in the on-highway market aftertreatment-forcing PM standards took effect in 2007 with similar NOx standards fully effective in 2010, and a similar phasing-in has been instituted in the nonroad engine market. The commenter stated that with this, EPA has recognized the limitations of manufacturers in making large technological jumps all at once, and has served its own desire, which EMD supports, to address PM emissions more urgently than NOx. The commenter stated that it believes that such phasing is particularly important in the locomotive—and, incidentally, the Category 2 marine engine (most of which are derivatives of locomotive engines)—market, because locomotive manufacturers are relatively small companies with limited resources. EMD urged EPA to resist any requests for introduction of aftertreatment for both NOx and PM at the same time.

AAR commented that it does not believe that the Tier 4 standards could be effective earlier because there is no basis for believing the research and testing that needs to be done to meet those standards will be completed before the proposed effective dates. The commenter noted that the standards will require aftertreatment devices, diesel particulate filters (DPFs) for PM control, and selective catalytic reduction (SCR) systems for NOx control. The commenter stated that, in general, new technology must be field-tested for at least two years before it can be implemented on a widespread basis; and aftertreatment is such a major change that more than two years of field testing will likely be necessary. The commenter stated that it believes that it will be years before DPF and SCR systems for line-haul locomotives will be available for testing because there has been little research on aftertreatment systems for locomotives compared to research on highway vehicles, especially with respect to high horsepower line-haul locomotives. The commenter noted that over the last ten years, the average number of brand-new locomotives placed in service by U.S. freight railroads was 773. AAR commented that because the locomotive market is so small, and heavy-duty motor vehicles have a 2010 deadline by which they will need to be equipped with both DPF and SCR systems, the aftertreatment industry has focused its resources on developing systems for motor vehicles (not nonroad vehicles/equipment).

EMA commented that it believes that the fact that metal catalyzed diesel particulate filter (metal-CDPF) systems have not been demonstrated in large size applications should be recognized. The commenter noted that the required scale-up to large units is not trivial, and substantial lead time (several years) is needed to have units designed, built, and tested to have any certainty that they will function and survive in marine or locomotive applications. The commenter further noted that redesign to incorporate what is learned in the field also may be needed.

The Northeast States for Coordinated Air Use Management (NESCAUM) encouraged EPA to require Tier 4 emissions levels for both NOx and PM by no later than the end of 2013, rather than the respective proposed dates of 2017 and 2015.

The National Association of Clean Air Agencies (NACAA) recommended that the implementation dates for new engine and remanufacture standards be accelerated. The commenter noted that technical experts within NACAA (including those from the California Air Resources Board (CARB) and the South Coast Air Quality Management District (SCAQMD)) believe that Tier 4 NOx and PM standards for new engines at least as stringent as those proposed are technologically feasible by the end of 2013. NACAA recommended that EPA advance the rule's implementation dates accordingly.

The New Jersey Department of Environmental Protection (NJDEP) recommended that the proposed locomotive emission standards implementation schedule be accelerated, based on the rationale outlined by NESCAUM and NACAA. The commenter said that the Tier 4 emission standard implementation schedule should be shortened. NJDEP expressed support for the proposed Tier 4 1.3 g/bhp-hr NOx emissions standard and 0.03 g/bhp-hr PM standard for new locomotives by the end of 2013, rather than 2017 and 2015, respectively. NJDEP commented that most of EPA's rationale for the proposed standards timetable is due to current technology and future technology assumptions. The commenter noted that it hired an expert in the field of diesel emission reduction technology; this expert developed a report (OAR-2003-0190-0562.3) which demonstrates that the technology is far enough along to support an accelerated timetable.

The Missouri Department of Natural Resources (MDNR) recommended shortening the time period until the implementation of both the new engine emission standards and remanufactured engine emission standards for locomotives. The commenter requested that the standards be implemented as soon as they are technically feasible to allow for emissions reductions as soon as possible.

The Puget Sound Clean Air Agency commented that the rule can be improved significantly by advancing the dates on which new and remanufactured engine standards are implemented.

The Wisconsin Department of Natural Resources (WDNR) requested that EPA accelerate the implementation dates for emission standards for new and remanufactured locomotives.

The Ozone Transport Commission (OTC) commented that its member states encourage EPA to examine the effective dates for many of the standards proposed. The commenter recommended that EPA finalize a 2013 deadline for the proposed Tier 4 locomotive standards.

The South Coast Air Quality Management District (SCAQMD) commented that, based on its own research and commercialization efforts on advanced emission control technologies and deployment of cleaner alternative fuels and diesel fuel alternatives under the SCAQMD Clean Fuels Program, the proposed compliance schedules can be substantially accelerated. SCAQMD commented that it strongly urges EPA to move up the proposed Tier 4 standard for new locomotive engines to June 2012 (at the latest), when ULSD will be required for locomotives. The commenter noted that the proposed dates for new locomotive Tier 4 PM engine standards fall in the deadline year for the South Coast region and the San Joaquin Valley to meet the federal annual PM2.5 air quality standard. The commenter stated that the proposed deadline is too late to provide any assistance in meeting the federal annual PM2.5 standard, given that the proposed advanced control standards for locomotives only apply to new units and the resulting need to allow time for fleet turnover before benefits are realized. The commenter further suggested that the implementation date for the Tier 3 standards be moved to the end of 2010.

SCAQMD commented that it agrees with EPA's statement that the Tier 4 locomotive standards are feasible using today's technology, and stated that there is no need to delay implementation of these standards to await development of technology. The commenter noted that the Clean Air Act (CAA) (at section 213(b)) requires EPA to adopt standards which "take effect at the earliest possible date", thus the commenter stated that Tier 4 technology must be required as quickly as manufacturers can gear up to produce it.

SCAQMD commented that its staff has been in discussion with CARB staff on a proposal that could deploy Tier 4 locomotives by 2010. The commenter stated that the proposal is based upon the use of multiple off-road engines in conjunction with DPFs and SCR to achieve or exceed the proposed Tier 4 emission standards. SCAQMD commented that it views this proposal as particularly promising because it relies on existing, commercially available engines, and because such multiple engine configurations have been successfully utilized to create lower emission switch locomotives. The commenter stated that it believes that there is no technical reason why such engines and configuration should not be able to achieve a Tier 4 line-haul locomotive in a timeframe enormously accelerated from EPA's proposed regulation. (The commenter noted that a copy of the presentation from NREC and Cummins attached to its public comments.)

The City of Houston, Bureau of Air Quality Control (BAQC) requested that EPA require compliance with the Tier 4 PM, HC, and NOx emissions standards by no later than June 2012 because it is achievable.

Letters:
Association of American Railroads (AAR) OAR-2003-0190-0566.1
City of Houston, Bureau of Air Quality Control (BAQC) OAR-2003-0190-0561.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0545
General Electric Transportation (GE) OAR-2003-0190-0590.1
Manufacturers of Emission Controls Association (MECA) OAR-2003-0190-572.1

Missouri Department of Natural Resources (MDNR) OAR-2003-0190-0658
National Association of Clean Air Agencies (NACAA) OAR-2003-0190-0495
New Jersey Department of Environmental Protection (NJDEP) OAR-2003-0190-0562.2
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0551.1
Ozone Transport Commission (OTC) OAR-2003-0190-0633.1
Puget Sound Clean Air Agency OAR-2003-0190-0484
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0483, 0558.1
Wisconsin Department of Natural Resources (WDNR) OAR-2003-0190-0552

Our Response:

Many of the comments summarized here reflect the general concern that much of the rail industry has felt regarding the introduction of advanced PM and NOx control technologies in our proposed Tier 4 program. Unlike the marine sector - where high-speed marine engine manufacturers have significant experience with advanced control technologies for their on-highway and nonroad products - locomotive manufacturers do not have this experience and have therefore been more cautious in accepting such significant new technologies. To address their concerns, we engaged in extensive outreach with the rail industry (including all of the commenters here) to ensure that they fully understood our expectations for what the proposed Tier 4 locomotive program would mean. Included in that outreach was cooperative testing to evaluate in-use conditions expected of locomotives operating in high altitude tunnels and our own testing at the National Vehicle and Fuel Emissions Laboratory to demonstrate the emission results that would be expected of a Tier 4 locomotive engine design. The result of all of this work is reflected in our Final RIA and in memorandums to this rulemaking docket.

As an outgrowth of the comments summarized here and the results of our analyses, outreach and test programs, we have made some important changes in our final rulemaking. In particular, we agree with commenter GE that it may be more appropriate for an in-use add-on designed to account for unforeseen issues with technology or manufacturing to extend for a number of model years consistent with the expected useful of a locomotive (7-8 years). In this way, manufacturers can benefit from learning through a longer period of in-use data gathering and can be assured that the locomotives they design and produce will always be in compliance with EPA regulations. We have therefore provided a new interim regulatory option in §1033.150 (described in section IV of the preamble) that sets a longer period for the in-use add-on for NOx while manufacturers continue to evaluate the durability of the emission controls. At the same time, we have eliminated a regulatory provision that would have allowed the Tier 4 NOx standard to be delayed until 2017. In our final rule, the Tier 4 NOx and PM standards begin concurrently in 2015. As described in the final RIA, we believe such an approach is more appropriate reflecting not only our need to set the most stringent emission standards feasible, but also the considerable synergies that exist between the NOx and PM emission control technologies.

The commenter describing the statement of MECA at our public hearing has misunderstood the statement of MECA and their intent. The MECA testimony clearly said that the Tier 4 standards could be achieved by 2015, without specifically describing when the first catalyst samples would be available for locomotive testing. On September 27, MECA sent a letter to the Agency clarifying that SCR catalyst manufacturers are already providing catalyst samples for evaluation by locomotive manufacturers today, and would begin to provide samples for full-size, zeolite-based SCR locomotive evaluations in 2010, with production-intent SCR catalyst samples for extended field trials on locomotives available in the 2012-2013 timeframe. MECA further reiterated its position that this would allow full implementation of the Tier 4 NOx standard in 2015. We also believe that catalytic PM and NOx controls in other sectors have now developed to the point where systems are being introduced that integrate both an oxidation function (for PM control) and SCR (for NOx control). Integration of the catalytic controls for PM and NOx has reduced or eliminated the advantage of a stepwise approach to the introduction of PM and NOx emission standards from a workload perspective. We believe that it is technologically feasible to introduce both the Tier 4 NOx and PM standards in 2015.

Catalyst suppliers system integrators will have full-size, prototype Tier 4 systems ready for testing by 2010 (see MECA letter in docket EPA-HQ-OAR-2003-0190-0730). This will leave sufficient lead-time for two years of initial prototype testing, two years of extended field trials on production-intent designs, and one year for production implementation in Tier 4 locomotives by January of 2015. Metal CDPF systems are in full series production for truck applications in Europe. Metal substrate designs with 250 cm diameters are entering production for large nonroad applications. Catalyst system integrators such as Tenneco and Clean Air Systems are also developing catalyst systems for large engine applications that are built from parallel substrates produced in standard high-unit-volume heavy-duty truck substrate sizes in an effort to reduce costs and use proven catalyst mounting systems. For all of the reasons summarized here and in the final RIA, we have concluded that it is appropriate for the Tier 4 locomotive NOx and PM standards to begin in 2015.

While our updated analysis now leads us to conclude that we should begin requiring compliance with both the Tier 4 NOx and PM standards in 2015, several commenters stated that we should implement Tier 4 locomotive standards in 2013, or even earlier. We continue to believe that locomotive manufacturers do not have the resources to complete all of the engineering work needed to bring Tier 4 locomotives to market in that time frame while simultaneously upgrading their Tier 0, 1, and 2 designs to meet the new standards. Moreover, as described in the RIA, we considered an alternative scenario in which we would have pulled the Tier 4 standards ahead to 2013, but eliminated the new Tier 2 and Tier 3 standards. We found that, even if it were feasible to do so, diverting resources from the Tier 2 and Tier 3 standards in order to pull the Tier 4 standards ahead to 2013 would actually increase overall emissions.

Finally, we disagree with SCAQMD's assertion that there are no technical reasons why manufacturers cannot create Tier 4 locomotives earlier using multiple high-speed nonroad engines in line-haul applications. This ignores the fact that medium-speed engines have significant efficiency and durability advantages over high-speed engines, and these advantages are important for line-haul applications. Moreover, the redesign effort required to produce 4,000 hp line-haul locomotives using multiple high-speed engines could very well take more time than would be required to produce Tier 4 locomotives using medium-speed engines.

10.2.2 Additional Lead-Time Needed to Establish Locomotive Catalyst Deterioration

What Commenters Said:

GE commented that it believes that if greater than expected deterioration is seen, it will most likely be due to a fundamental shortcoming in the technology when exposed to the harsh railroad environment. The commenter stated that it believes three years of actual in-use operation may be sufficient to expose any expected problems; however, if the solution involves more than just minor design adjustments, the commenter stated that three years would not be enough time to find, validate, and apply solutions to new locomotives. GE further noted that if unexpected deterioration does occur and is only due to easily-corrected minor miscalculations, the solution would be implemented in the shorter time frame EPA has proposed. The commenter noted that if unexpected deterioration is due to a more fundamental technology shortcoming, the useful life approach or the ability to apply for additional time would provide the manufacturer a more realistic schedule in which to address it.

GE further commented that, with regard to the proposed in-use deterioration add-on being applied to the first 3 model years of the Tier 4 PM and NOx standards, it believes that EPA should include the proposed deterioration adjustments of 40 CFR 1033.150(f) for model years 2015-2017 but should extend the allowance for the full useful life of these locomotives to take into account the possibility that a major redesign is needed to resolve a problem. The commenter stated that, alternatively, EPA could allow a manufacturer to request and obtain approval to continue to apply these factors after the three-year period elapses, based on a demonstration that more time is needed to resolve the issue.

Letters:
General Electric Transportation (GE)OAR-2003-0190-0590.1

Our Response:

As we note in Chapter 4 of the RIA, it is reasonable to conclude that aftertreatment components will be durable in the locomotive environment for model years 2015 and later. The information EPA relies on shows that aftertreatment components expected to be used have proven durable in other applications and should also be durable in locomotive applications. While we agree in concept with GE's comment that NOx catalyst durability cannot be demonstrated with absolute certainty without testing a significant number of locomotives under in-use conditions, the Clean Air Act requires us to base our standards on technology that "will be available" rather than technology that is already proven to a certainty for all conceivable engines.

Nevertheless, we have determined that it would be appropriate to extend the period over which an in-use adjustment factor would apply for NOx emissions. Should durability problems occur, this extension will provide manufacturers with sufficient lead time to implement design changes needed to correct such problems. It is important to note, however, that adjustments allowed during the extended should be smaller than those proposed, because the possible environmental consequences of an extended in-use adjustment at the larger level are not justified. Under the final regulations, manufacturers will have the option of applying the larger proposed adjustments for three model years or the new smaller adjustments for the extended period.

We have not provided the same extended period for the PM in-use adjustment factors because the deterioration mechanisms and expected performance of the PM control technologies we project that manufacturers will use to comply with our Tier 4 standards are much better understood. See Chapter 4 of the RIA for a complete description of the deterioration mechanisms and in-use performance we project will be realized through the application of Tier 4 NOx and PM control technologies.

10.2.3 Stringency of Tier 3 and Tier 4 Locomotive Standards

What Commenters Said:

EMD commented that it believes that EPA should rethink basing the Tier 3 and Tier 4 switch standards on high-speed nonroad engine technology, because of the unproven nature of such technology in rail service and because of the loss of the benefits of medium-speed engines.

AAR commented that the railroads are concerned about the disparity between the Tier 4 NOx standard for locomotives and the Tier 4 NOx standard for marine engines. The commenter noted that, as EPA discusses in its RIA, a marine engine achieving a 1.3 g/bhp-hr NOx standard would only meet a 1.7 g/bhp-hr standard when tested to the locomotive duty cycle. The commenter noted that its understanding is that locomotive and marine engines of comparable horsepower are very similar and should have virtually identical emissions characteristics. The commenter noted that EPA dismisses the concern over a disparity in the standards applicable to locomotive and marine engines by making several observations, and stated that it does not believe that any of the observations hold up to scrutiny (marine engines are starting from a higher NOx regulatory limit, locomotives will benefit from stop/start, the main engines of a comparable size will be subject to Tier 4 NOx standards three years sooner). The commenter raised the concern that railroad operating environment provides greater engineering challenges than the marine environment as they have comparatively little space for aftertreatment, are subject to high temperatures in tunnels, and operate at high altitudes. The commenter stated that if there will be a difference between the emissions standards for comparable locomotive and marine engines, EPA should offer a better explanation.

AAR also noted that in the preamble EPA asked whether additional NOx reductions (beyond the proposed Tier 3 line-haul standards requiring a 50% reduction PM emissions reduction and maintaining the Tier 2 NOx level, effective 2012) would be feasible for Tier 3 locomotives. The commenter stated that additional reductions for Tier 3 NOx would not only have unacceptable consequences for the railroads and locomotive builders, they also would be contrary to the public interest and undermine EPA's objectives. The commenter further noted that, as stated in the preamble, additional NOx reductions could be obtained through retarded engine timing, but the price would be a significant fuel penalty, with an increase in both carbon and PM emissions. AAR also commented that add-on exhaust gas recirculation (EGR) would not be a good option, as it would entail a significant fuel penalty, increased carbon emissions, and would discourage railroads from buying newer, lower emitting locomotives and divert resources from developing Tier 4 locomotives. The commenter noted that railroads are not going to be interested in buying locomotives with short-term technology that would only be used for a few years; the commenter believes that equipping Tier 3 locomotives with a short-term technology would provide the railroads with an incentive to delay the acquisition of new locomotives. Further, the commenter stated, the railroads are capable of keeping existing units in service rather than replacing them with new technology through the remanufacturing process. AAR also commented that locomotive builders have finite resources to devote to a market where an average of 773 new locomotives are put into service each year—if they are forced to devote resources to a short-term technology such as EGR (which is similar in necessary development time to SCR systems), the development of the next stage in emissions technology, aftertreatment-equipped locomotives, would likely suffer. Lastly, AAR commented that it found EPA's statement in the preamble that "a Tier 3 NOx standard below 5 g/bhp-hr might be achievable with a limited impact if additional engineering resources were invested to optimize such a system for general line-haul application" to be puzzling.

Letters:
Association of American Railroads (AAR)   OAR-2003-0190-0566.1
Electro-Motive Diesel, Inc. (EMD)   OAR-2003-0190-0594.1

Our Response:

We disagree with EMD's comment that EPA should not base the Tier 3 and Tier 4 switch standards on high-speed nonroad engines. Since switch locomotives using high-speed engines are currently being produced in greater numbers than medium-speed switch locomotives, they are an appropriate basis. Moreover, we do not believe that these switch standards will necessarily result in the loss of medium speed engines from switch rail service. EMD recently introduced the low emission 710ECO series medium speed engines for switch service, which could serve as a developmental engine platform for Tier 3 and Tier 4 medium speed switch locomotive applications. In chapter 4 of the Final RIA, we describe the technologies that we expect to be used to meet Tier 3 and Tier 4 emissions with medium speed engines. A summary of the technologies we expect will be used for medium speed switch locomotives to meet the Tier 3 standards is included in table 4-1 of the RIA (and was also included in the Draft RIA, in table 4-1). We believe that the SCR and CDPF technologies described for Tier 4 medium duty engines can be applied to locomotive switch applications, that these engines will be available in the marketplace, and that we should not allow increased emissions standards for a particular engine type.

In response to AAR's comments regarding the relative parity of the locomotive and marine Tier 4 NOx standards, we are finalizing the most stringent NOx emission standards that we believe feasible for both locomotive and marine diesel applications giving full consideration to the numerous differences between these applications. For example, many Category 2 marine engines certified to the Tier 2 marine standards differ from locomotive engines and include significantly higher power rating and per-cylinder displacements. As described in Chapter 4 of the Final RIA, large-bore medium speed Category 2 marine engines will need a higher NOx conversion efficiency when applying SCR to their Tier 2 engine designs than will be the case for locomotive applications. Regarding the differences in peak exhaust temperatures encountered between locomotive and marine applications, the peak temperatures encountered at altitude for the most extreme operation by heavy-haul trains in unventilated tunnels are still well below the temperatures at which significant thermal degradation occurs when using base-metal zeolite urea SCR NOx emissions controls. Please refer to our response to comments in section 10.2.5 of this document for further discussion of the impact of high altitude tunnel operation on SCR durability. Regarding the space available for the emissions control systems, please refer to the detailed discussion of packaging feasibility in section 4.3.3.

As explained in Section III of the preamble, we agree with AAR's evaluation regarding a number of the issues related to setting a more stringent Tier 3 NOx standard. Hence, we are finalizing a Tier 3 program that does not reduce the NOx emission standard below the level set in our Tier 2 program.

10.2.4 Technology Transfer to Locomotive from Other Sectors

What Commenters Said:

MECA noted that DPFs are commercially available today, in many retrofitted heavy-duty vehicles and new light-duty vehicles worldwide. The commenter further noted that new highway vehicles will be equipped with DPFs to meet the 2007 highway diesel requirements and the light-duty Tier 2 requirements. MECA commented that DPFs have been successfully installed and used on thousands of nonroad applications such as: mining, construction, and materials handling equipment, where vehicle integration has been challenging. The commenter also noted that particulate filters (many employing active regeneration strategies such as fuel burners or electrical resistance heaters) have also been used on over 200 locomotives in Europe since the mid-1990s. The commenter stated that they have provided in excess of an 85 percent reduction in PM emissions, and some systems have been operating effectively for over 650,000 kilometers. Further, a limited number of these active DPF systems have also been safely equipped on marine vessels in Europe to control PM. MECA also offered examples of demonstration projects in the U.S. evaluating DPF feasibility for locomotive and marine engines: a U.S. Navy work boat/barge retrofitted with an active DPF system, active DPF systems (similar to those equipped on European locomotives) have been retrofit on two 1500 hp switcher locomotives operating in rail yards in southern California, and DPFs will be demonstrated on two commuter rail locomotives operating between Oakland and Sacramento.

MECA commented that, recently, metal substrate filter designs have been developed and introduced for PM control of diesel engines. The commenter noted that these designs combine more tortuous flow paths with sintered metal filter elements to achieve intermediate PM filtering efficiencies that can range from 30 to 70% depending on engine operating conditions and the soluble content of the diesel particulate matter emitted by the engine. Like ceramic wall-flow filters, these metal filter designs can be catalyzed directly or used with an upstream catalyst to facilitate regeneration of soot captured by the substrate. The commenter also noted that these metal substrate filter designs have been verified by the California Air Resources Board as a Level 2 retrofit device ($\geq$50% PM reduction) on a range of highway diesel engines, used by an engine manufacturer in Europe for complying with Euro 4 heavy-duty diesel PM limits, and are available in Europe as a retrofit PM technology for light-duty diesel vehicles. Lastly, the commenter noted that their more open designs allow them to operate over very long timeframes without the need for cleaning the substrate of trapped lubricant oil ash.

MECA commented that diesel oxidation catalysts (DOCs) are a well-proven technology for oxidizing gaseous pollutants and toxic hydrocarbon (HC) species present in diesel engine exhaust, and are effective at reducing diesel PM emissions through the catalytic oxidation of soluble hydrocarbon species adsorbed on soot particles formed during combustion. The commenter noted that DOCs can also oxidize nitric oxide (NO) present in the engine exhaust to nitrogen dioxide (NO_2), which can be used to oxidize soot captured on a DPF at relatively low exhaust temperatures ("passive filter regeneration") or to improve the low temperature performance of SCR catalysts by providing a more kinetically variable mixture of NO and NO_2 to the SCR catalyst. The commenter suggested that both the oxidation of soluble PM species and NO oxidation pathways could be useful in meeting the proposed Tier 4 locomotive and marine diesel standards. MECA noted that over two million oxidation catalysts have been installed on new heavy-duty highway trucks since 1994, and many new 2007-compliant heavy-duty trucks on the market include an oxidation catalyst upstream of a catalyzed diesel particulate filter in order to reduce PM emissions to levels below 0.01 g/bhp-hr. Additionally, oxidation catalysts have been used on millions of diesel passenger cars in Europe since the early 1990s, and they have been installed on over 250,000 off-road vehicles around the world for over 30 years.

MECA commented that SCR technology is a proven NOx control strategy that has been used to control NOx emissions from stationary sources for over 20 years. The commenter noted that more recently, SCR has been applied to mobile sources including trucks, nonroad equipment, and marine vessels; applying SCR to diesel-powered engines provides simultaneous reductions of NOx, PM, and HC emissions. The commenter noted that open loop SCR systems can reduce NOx emissions from 75 to 90 percent, and closed loop systems on stationary engines have achieved NOx reductions of greater than 95 percent. Modern SCR system designs have been detailed for mobile source applications that combine highly controlled reductant injection hardware, flow mixing devices for effective distribution of the reductant across the available catalyst cross-section, durable SCR catalyst formulations, and ammonia slip clean-up catalysts that are capable of achieving and maintaining high NOx conversion efficiencies with extremely low levels of exhaust outlet ammonia concentrations over thousands of hours of operation. The commenter noted that heavy-duty engine manufacturers worldwide are currently offering urea-SCR systems in highway truck applications, combined DPF+SCR system designs are being considered to meet the 2010 heavy-duty highway standards, and DOC+SCR systems are also being used commercially in Japan in new diesel trucks. The commenter also noted that several technology providers are developing and demonstrating retrofit SCR systems for both highway trucks and off-road equipment.

MECA commented that it recognizes that the proposed Tier 4 locomotive and marine diesel engine standards present engineering challenges, but it believes those challenges can and will be met. The commenter stated that it believes that the key will be to employ the systems approach identified in the NPRM consisting of the further evolution of locomotive and marine diesel engine designs, the use of advanced emission control technology, such as diesel particulate filters and SCR catalyst systems, the use of ULSD, and the use of low ash and sulfur-containing lubricants. The commenter noted that it has reviewed EPA's Tier 4 technical feasibility discussion and agrees with EPA's technical assessments. MECA further commented that it and its member companies firmly believe that high efficiency and durable diesel particulate filter and SCR catalysts meeting the EPA technical assumptions for the proposed Tier 4 standards on locomotive and marine diesel engines will be available in the 2015 timeframe. The commenter also stated that it believes that both Tier 4 locomotive and marine diesel SCR applications will benefit from continued development efforts on SCR systems that will be driven by much higher volume applications on light-duty vehicles, heavy-duty vehicles, and off-road diesel-powered equipment.

GE commented that with the Tier 4 NOx standard, the solutions are being developed by the manufacturers of aftertreatment devices who have little experience with the parameters of the locomotive operating environment. The commenter noted that locomotive manufacturers will be unable to ship locomotives if the standards are not achieved or if the aftertreatment systems are made available by the suppliers but the catalyst fails. The commenter stated that because of this, the locomotive manufacturers bear potential penalties under the proposal for failing to achieve the standard and the railroads that bear the severe economic disruption associated with locomotives that are unable to operate due to nonconformities with emissions standards. GE stated that it believes this adversely impacts the fair market dynamics of the railroad industry. The commenter further stated that it believes that the deterioration studies for the zeolite catalysts show that a beginning of useful life emissions level of 0.8 g/bhp-hr will degrade to 1.9 g/bhp-hr by the end of the locomotive's useful life. The commenter stated that, for this reason, if EPA proceeds with a Tier 4 standard that requires aftertreatment, it is incumbent on EPA to ensure that the suppliers of the control systems will have controls available for testing and that the catalyst has been shown to maintain its effectiveness. GE commented that it believes that a regulatory review of catalyst deterioration in 2010 is both appropriate and necessary to ensure that the Tier 4 NOx standard is achievable, regardless of whether EPA sets the standard at 1.9 or 1.3 g/bhp-hr.

Letters:
General Electric Transportation (GE)OAR-2003-0190-0590.1
Manufacturers of Emission Controls Association (MECA) OAR-2003-0190-572.1

Our Response:

MECA's statements are consistent with our observations and are similar to what EPA has stated within the RIA. MECA's comments regarding performance and durability of DPF, SCR, and DOC systems and successful demonstration in marine vessels are also consistent with recent EPA laboratory test results (see docket EPA-HQ-OAR-2003-0190).

As described in our response to 10.2.1, we take seriously the locomotive manufacturers concerns about the unique parameters that locomotive engines operate under (most importantly tunnel operation), and we worked with the industry including the commenters here to evaluate tunnel operating conditions as summarized in the RIA. We believe that the challenges facing application of these technologies to locomotives such as packaging constraints, the exhaust chemistry encountered, the temperatures encountered, shock, vibration and ambient conditions are not fundamentally unique to the locomotive sector and successful design approaches have been developed and implemented to address each of these issues in other diesel engine applications as shown by our testing at the National Vehicle and Fuel Emission Laboratory. We believe that the 1.3 g/bhp-hr standard adequately takes into account SCR catalyst degradation over the useful life of a locomotive, particularly when considering that thermal degradation is the primary means of catalyst deactivation and that the worst case exhaust temperatures encountered during locomotive operation are notably less severe than those encountered with heavy-duty highway truck applications as described in our test report on locomotive tunnel operation and our RIA.

10.2.5 Long-Term Durability of Locomotive Aftertreatment Technologies

What Commenters Said:

GE commented that it appears that EPA is relying in part on assurances from MECA's claims that the catalysts represent no difficulty in terms of deterioration. The commenter noted that MECA has cited [to GE] stationary applications as support for the concept that units can operate with zeolite for long periods at high temperatures, suggesting that the same should be true for locomotives. The commenter stated that they believe this statement is not correct for the following reasons: most stationary turbines result in exhaust temperatures in the range of 450 °C with little variation, while locomotives have operations that can reach 700 °C for significant periods of time; stationary systems have ample space available for aftertreatment systems (thus assuring appropriate mixing of ammonia with the exhaust prior to the SCR system), catalyst change-out rarely occurs because standard operating practice is typically to add new catalyst bricks to the existing system; catalysts systems used in stationary applications do not experience the frequent, severe mechanical shock loads or exposure to the elements that are present in locomotive operation; and reducing a low NOx stream with a urea-based SCR requires lower concentrations of urea (and thus lower ammonia concentrations due to slip).

GE also commented that there are a number of data sources clearly showing that catalyst degradation is governed by accumulated exposure to high temperature over time. The commenter raised that concern of the length of exposure to high temperatures for the DOC and the SCR zeolite catalyst in the locomotive environment. The commenter noted that, at 72 FR 15981, EPA stated that the Agency's review of long term catalyst durability leads to the conclusion that durable catalysts already exist and have been applied to urea SCR NOx emissions control systems that are similar to those EPA expects to be implemented in the locomotive and marine environment. The commenter stated that while EPA has reviewed the data available prior to proposal for the truck industry, EPA did not take into account that the catalyst system used in the truck industry cannot be used successfully in locomotives due to the longer periods over which the catalyst will be exposed to high operating temperatures in locomotives. The commenter stated that these high temperatures increase the potential for thermal degradation of the zeolite catalyst from the locomotive exhaust to a degree that is substantially higher for locomotives than for trucks.

NJDEP responded to the request for comment on the comparative and unique engine scenario NOx control information when the engine is equipped with either zeolite or vanadium SCR and operating on the marine and locomotive duty cycle. The commenter stated that locomotive and marine engine applications are not uniquely different from highway and nonroad applications. The commenter noted that many vanadia-based SCR units have been applied successfully to both locomotives and marine engines and have performed for many operating hours with excellent performance. The commenter further noted that zeolite-based SCR is being studied for these applications. The NJDEP commented that with the combination of Best Available Technology (BAT) DPF + SCR, both types of SCR are protected from known catalyst poisons by the BAT DPF that removes 99+% of solid metal ash poisons and surface glaze compounds thus protecting the SCR unit from progressive performance decline. Thus, the commenter stated, the high level of SCR NOx performance is expected to be maintained.

NJDEP also responded in reference to request for comment on whether 45% DOC efficiency is required by certain types of SCR systems to maintain greater than 94% zeolite SCR efficiency to meet the Tier 4 1.3 g-bhp-hr NOx standard under the temperature range of the line-haul duty cycle. The commenter responded that the engine baseline NOx level (which would require 94% NOx reduction to reach 1.3 g/bhp-hr NOx) is 22 g/bhp-hr, the remanufactured engine Tier 0 and Tier 1 NOx standard is 7.4, and Tier 2 is 5.5 g/bhp-hr. The commenter also noted that the new Tier 3 emission standard is 5.0 g/bhp-hr NOx. NJDEP further commented that a 94% SCR NOx efficiency applied to 5.0 g/bhp-hr engine out baseline would achieve 0.3 g/bhp-hr NOx tailpipe emissions, and thus the 94% conversion rate mentioned in the NPRM's question 3 will not be needed. The commenter stated however, that it believes that 94% NOx is remarkably achievable with SCR NOx technology and it can be employed in the "systems approach" to bring improvements to diesel engine specific fuel consumption as noted in the detailed comments and elsewhere. The commenter further stated that it believes that more than 45% DOC oxidation of NO to NO_2 is achievable with a platinum DOC from below 200 °C to around 400 °C depending on space velocity and catalyst formulation. NJDEP also noted that BAT DPF technology, if used for locomotives, will certainly meet the 0.01g/bhp-hr PM standard (the current HD 2007 standard) and remove all insoluble solid lung alveoli nanoparticles that are regarded by health authorities as the size specific fraction of most concern.

Regarding soot exposure, NJDEP noted that engine-out soot will be cleansed with a BAT DPF system and therefore soot will not affect SCR catalysts. The commenter stated that it is noted that so-called partial filters would not prevent SCR soot and metal-ash exposure. The commenter recommended that only verified best available filter technology be permitted. The commenter suggested that there is also a need for a thorough SCR NOx verification procedure (already started in Europe with an open invitation to EPA to join). Lastly, the commenter stated that SCR NOx catalyst high temperature hydrothermal exposure limits have improved and low and high temperature SCR NOx selectivity is also improving due to manufacturer development work.

Letters:
General Electric Transportation (GE) OAR-2003-0190-0590.1
New Jersey Department of Environmental Protection (NJDEP) OAR-2003-0190-0562.2

Our Response:

With regard to the GE's concern about catalyst deterioration due to accumulated time at high temperatures, and the potential for 700 °C locomotive exhaust temperatures, EPA worked with the locomotive manufacturers and the railroads to determine maximum post-turbine exhaust temperatures under worst case operational conditions. We worked jointly with GE, EMD, Union Pacific Railroad, BNSF Railway, and Southwest Research Institute to conduct high-altitude testing of two Tier 2 locomotives operating in the rearmost positions within a multiple locomotive consist pulling a heavy freight train through multiple unventilated tunnels in the Donner Pass region of California and Nevada in August, 2007. Exhaust temperatures, other engine data, locomotive data and ambient conditions were monitored over the same route used by GE during its development of the GEVO locomotive. Maximum post turbine exhaust temperatures were encountered during operation in a long unventilated tunnel where ambient air temperatures exceeded 100 °C (212 °F) due to the exhaust flow and heat rejection from the locomotives into the tunnel. Under these extreme conditions, the Tier 2 GE locomotive reached a maximum post-turbine exhaust temperature of 560 °C. During analysis of the engine and locomotive data during the tests, it became clear that this represented a maximum achievable exhaust temperature, and that the maximum temperature was self-limited by measures taken by the electronic engine management to prevent engine damage that could result from exceeding oil temperature limits, coolant temperature limits and the temperature limits of engine components. The results have been shared with GE, EMD, and AAR, and a detailed report of this testing is included in docket EPA-HQ-OAR-2003-0190.

We relied on data generated during the development of base-metal zeolite systems for on-highway diesel and other applications in our analysis. The MECA citation of stationary gas turbine applications (see section 10.2.4, above) is relevant, although GE's characterization of the operating conditions is not accurate for gamma-exchanged iron zeolite (Fe-zeolite) SCR gas-turbine applications. Typical gas-turbine applications using exhaust heat recovery operate with exhaust temperatures at or below 450 °C, as stated in the comments, and thus have been able to use vanadium-based SCR systems for NOx control. Extruded vanadium catalysts and coated vanadium-tungsten-titanium mixed oxide (VWT) catalysts have maximum operating temperatures of 540 °C and 600 °C, respectively. Above those temperatures, vanadium-based catalysts suffer irreversible thermal degradation. The maximum operating temperatures for vanadium-based SCR catalysts prevented their application to gas-turbine engines operated without exhaust heat recovery, which have sustained operation with exhaust temperatures of 550 to 650 °C. Fe-zeolite SCR was originally developed for precisely this special case of controlling NOx emissions from gas-turbines operated without exhaust heat recovery and this is the gas turbine application referred to by MECA. The use of Fe-zeolite SCR for these applications allowed operation at the much higher exhaust temperatures of gas turbines operated without exhaust heat recovery and also improved NOx conversion efficiency above 450 °C. Similarly high exhaust temperatures are encountered in heavy-duty diesel applications during forced regeneration of PM traps, thus for U.S. 2010 truck applications that combine forced PM regeneration with SCR, the primary control technology for NOx has been Fe-zeolite SCR rather than vanadium-based SCR. The Fe-zeolite SCR systems developed for U.S. highway truck applications have improved NOx reduction efficiency and thermal durability relative to systems previously developed for stationary gas turbine applications. Other base-metal zeolite catalyst formulations such as Cu-zeolite SCR have similar thermal durability to Fe-zeolite SCR and improved low temperature NOx reduction efficiency. Vanadium-based SCR systems are in production for truck applications in Europe, but these systems are not subjected to the higher temperatures of forced PM regeneration since the PM standards currently in place in Europe are not sufficiently stringent to require the use of PM traps. We understand that the thermal degradation of catalysts is a function of time, temperature and exhaust chemistry. The MECA gas turbine example represents conditions of sustained operation at higher temperatures than would be encountered in locomotive operation without causing severe damage to the locomotive engine. Durability data generated during development of high-temperature capable base-metal zeolite SCR systems for U.S. and European trucks is also consistent with MECA's example.[2]

GE also cited the frequent and severe mechanical shock present in locomotives as a durability concern. The shock requirements cited for locomotive applications, while greater than those for stationary applications, are similar to, or less than, the levels encountered in nonroad applications and on-highway applications that will be using similar SCR control technology (as described in Chapter 4 of the RIA and in section 10.4.8 below). In Chapter 4 of the RIA, we also

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[2] Smedler, G. "NOx Emission Control Options", SAE Heavy Duty Diesel Emissions Symposium, Gothenburg, Sweden, September 10-12, 2007.

describe how ammonia slip can remain low at high NOx reduction efficiency even with relatively high NOx feedgas rates through the use of static mixers, closed-loop urea dosing, and the use of a highly selective ammonia slip catalyst. Data published by Englehard (a catalyst manufacturer) and DAF (a European truck manufacturer) at the Society of Automotive Engineers (SAE) 2006 World Congress showed emissions results obtained using an ammonia slip catalyst configured into a hydrothermally aged SCR catalyst system operated at high space velocities. The data showed that greater than 90% NOx removal could be achieved with less than 25 ppm of ammonia slip even at excessive dosing rates of greater than 1.3:1 and with NOx feedgas concentrations higher than those of Tier 2 locomotives. More moderate dosing rates near 1:1 resulted in peak ammonia slip of 6 ppm or less.[3] Recent engine tests conducted by EPA also showed similar results of very low ammonia slip and high conversion at high engine-out NOx concentrations comparable to those of a Tier 2 GE locomotive (see docket EPA-HQ-OAR-2003-0190).

MECA, which represents a number of catalyst companies with extensive experience applying catalysts to a wide range of applications, states within their comments that they do not see circumstances unique to locomotive operation with respect to exhaust chemistry, temperature, vibration, shock or ambient conditions that have not already been encountered for application of similar PM and NOx controls to other diesel engine applications such as heavy-duty on-highway or nonroad diesels. MECA's assessment is consistent with our assessment of application of catalyst technology to locomotives, which is described in detail in Chapter 4 of the Regulatory Impact Analysis. Considering that fundamental catalyst research for NOx and PM control will not be necessary, the availability of hardware for testing is available in a timeframe that is consistent with a locomotive manufacturer's timeframe for hardware development. The timeframe needed for the introduction of engine and control system hardware to meet new emission standards was summarized by a locomotive builder in a presentation delivered at a symposium on locomotive emissions control hosted by the California Air Resources Board in Sacramento California on June 6, 2007. That presentation suggests that if catalyst samples can be provided for testing by 2010, the introduction of fully compliant locomotives can begin in 2015.

Hence, while we do reflect that in certain aspects of design and operation locomotive engines differ from their on-highway and nonroad counterparts, with regard to the specific instances that we have considered for technology transfer, we can conclude that, from the experience gained from on-highway and nonroad emission control development, technology transfer can occur.

10.2.6 Tunnel Operation

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[3] Hünnekes, E.V., van der Heijden, P.V.A.M., Patchett, J.A. "Ammonia Oxidation Catalysts for Mobile SCR Systems.

What Commenters Said:

AAR commented that locomotive engines present unique issues insofar as catalysts are concerned. Locomotives operate in tunnels in trains which have locomotives trailing other locomotives; the temperatures in the tunnels due to the exhaust from multiple locomotives are much higher than the temperatures catalysts will be exposed to when installed on other mobile source engines. Another important operating factor is vibration, exacerbated by the location of aftertreatment devices above the engine. Whether catalysts can maintain their efficiency at such high temperatures and extended periods of significant vibration is at best unknown.

EMD noted that EPA, in cooperation with Union Pacific, planned to conduct tunnel tests of EMD and GE locomotives for the purpose of understanding potential thermal aging deterioration of aftertreatment systems. The commenter noted that in measuring the temperatures around the test locomotives in tunnels, and the temperatures in the exhaust system, EPA should be cognizant of the challenges to exhaust aftertreatment systems posed by other factors of tunnel operation. The commenter provided the example that one of its rail customers operates locomotives in severe conditions that result in soot emissions that cause severely shortened maintenance intervals for locomotive air filters. The commenter noted that while a particulate filter will mitigate the soot emissions from individual locomotives, there are impacts on the aftertreatment system operation, including: 1) an oxidation catalyst - partial-flow particulate filter combination, as suggested by EPA, may not be appropriate here as particulate emissions in tunnels are likely to consist of a much higher fraction of soot than has been measured in open-air testing (if a partial-flow filter passes a significant fraction of the soot, fouling of the downstream selective catalytic reduction unit can be expected); 2) if a wall-flow filter is used for locomotives subject to tunnel operation (which, since locomotives are freely interchanged among railroads, can be any locomotive) its regeneration intervals will be severely shortened, with consequent increases in fuel consumption and potential operational impacts; lastly, 3) a wall-flow filter could be subject to uncontrolled passive regeneration when the locomotive leaves the tunnel and ingests fresh air (since the unit will be operating at full load), and the system may not survive such an occurrence. The commenter suggested that EPA make sure that its test is representative of the most severe tunnel operation, and carefully observe the effect of the tunnel on locomotive operation and emissions.

Letters:
Association of American Railroads (AAR) OAR-2003-0190-0566.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1

Our Response:

EPA has worked with EMD and a number of other rail industry partners to measure operating conditions “representative of the most severe tunnel operation.” In that testing, we observed significant engine de-rate occurring during operation within unventilated tunnels to prevent engine overheating. While the commenter is certainly correct that operation in unventilated tunnels does represent operation under oxygen depleted conditions, the higher equivalence ratio that would be attained if full-load were maintained through the tunnel is never realized because of engine de-rate due to the inability to effectively reject heat from the engine and locomotive under such high ambient temperature conditions. Also, the duration of operation in unventilated tunnels is relatively short from the perspective of DPF loading, particularly considering the relatively large DPF volume that will be required due to lower acceptable backpressure limits of locomotive engines in general and EMD 2-stroke engines in particular. Soot loading and passive regeneration within DPFs used for current heavy-duty truck applications is carefully monitored by calculating soot loading based on operational history, calculated or measured engine equivalence ratio, calculation of NO_2 available for passive regeneration or measurement of upstream NOx using zirconia sensors, and by monitoring inlet temperature and modeling catalyst temperatures. We expect a similar developmental effort and analogous controls will be applied to DPF systems used with locomotives.

With respect to items 2 and 3, the commenter did not provide an estimate of the increase of soot loading from tunnel operation, which would be necessary to evaluate whether or not wall-flow trap soot capacity would be exceeded for a given DPF size during the approximately fifteen minutes or less of sustained operation within an unventilated tunnel. Whether or not increased active regeneration would be needed or whether or not uncontrolled regeneration would occur would largely be a function of how much passive regeneration has occurred during locomotive operation and how much soot loading occurred within the trap irrespective of tunnel operation. Considering that current Tier 2 locomotives have approximately five to ten times the NOx to PM ratio of current on-highway trucks and considering that the temperature necessary for passive regeneration via NO_2 is available for most of the loaded locomotive throttle-notches, and also considering that engine-out PM emissions will be reduced further with the introduction of the Tier 3 PM standards (thus further improving the NOx to PM ratio for passive PM regeneration) we expect that there will be sufficient passive PM regeneration to prevent either uncontrolled PM regeneration or increased need for active PM regeneration under these scenarios. When taking into consideration the opportunities for passive PM regeneration within locomotive applications, it seems unlikely that the safe PM capacity of such a large PM trap system would be exceeded with the result being uncontrolled regeneration, particularly with such short durations of operation within unventilated tunnels.

10.2.7 Expected Performance of Locomotive Aftertreatment Technologies

What Commenters Said:

EMA commented on EPA's statement that the introduction of "CDPF systems utilizing metal substrates are a further development that trades off a degree of elemental carbon soot control for reduced backpressure, improvements in the ability of the trap to clear oil ash, greater design freedom regarding filter size/shape, and greater robustness" (72 FR 15980). EPA goes on to state that metal-CDPFs "were initially introduced ... to achieve approximately 60% control of PM emissions [and that] recent data from further development of these systems for Euro-4 truck applications has shown that metal-CDPF trapping efficiency for elemental carbon PM can exceed 70% for engines with inherently low elemental carbon emissions." EMA agrees that metal-CDPFs may have some potential to address several of the major questions concerning particulate exhaust filters. However, the basic limitation of particulate reduction efficiency must be recognized. Consequently, efficiencies above 60% should not be assumed for metal-CDPFs.

EMA also commented on EPA's claim that data from locomotive testing confirms a relatively low elemental carbon fraction and a relatively high organic fraction for PM emissions from medium-speed Tier 2 locomotive engines. EPA then states that a system with an oxidation catalyst and a metal CDPF would reduce overall PM emissions from a locomotive or marine diesel by upwards of 90%. While this may be true under some operating conditions on some engines, this does not account for the fact that the cycle emissions will be much less since the test cycles include operating points which will have less efficiency. This is especially true of the locomotive cycles, which include operation at idle for 59.8% of the time for switchers, and 38% of the time for line-haul locomotives. The exhaust temperature is less than 260°C at idle and at throttle notches below 3 for medium-speed locomotives. Also, the efficiency of a metal-CDPF cannot be extrapolated to smaller high-speed engines (or to purpose-built large marine engines). Consequently, using the high end of aftertreatment efficiency estimates as the generally achievable efficiency will lead to potentially infeasible standards. Stated differently, the basic limitations relating to the particulate removal efficiency of the metal-CDPF cannot be assumed away.

In its comments, MECA provided responses to the NPRM's request for detailed technical comments on the proposed Tier 4 standards and the use of catalyst-based controls to achieve the proposed emission levels, specifically on zeolite SCR performance/durability. The commenter stated that the available database of information on zeolite-based SCR catalysts shows that they are capable of maintaining high NOx conversion efficiencies at space velocities in the range of 40,000/hr at extended operations in 600 °C exhaust temperatures. The commenter also noted that some recent references supporting this statement were included in the Draft RIA.

MECA commented that the continued development and commercialization of durable DOCs, DPFs, and SCR catalyst systems is an important focus of the emission control industry and their customers in the engine, equipment, and vehicle manufacturing industries. The commenter also noted that the new "clean diesel" world of technologies also includes other options for catalyst-based controls for NOx, such as NOx adsorber catalysts (which are in commercial production on a number of light-duty and medium-duty diesel vehicles offered by various manufacturers). The commenter provided many examples of various technologies, demonstration projects, and technical papers in its comments.

MECA also commented that it agrees with EPA's technical discussion concerning the technical feasibility of designing SCR systems with low ammonia slip characteristics. The commenter stated that low ammonia slip SCR systems (e.g., 20 ppm or less ammonia peak concentrations in the exhaust exiting the SCR catalyst) have been and can be designed for locomotive or marine diesel applications. The commenter stated that achieving low ammonia slip includes proper sizing of the SCR catalyst and the design and control of the urea dosing system. MECA cited work being completed as part of the large U.S. Department of Energy Advanced Petroleum-Based Fuels-Diesel Emission Control Program, which includes evaluations of two different DPF+SCR systems on a modified heavy-duty highway engine. The commenter noted that in these systems, with only open loop control of the urea-dosing systems and the use of ammonia slip catalyst at the exit of the SCR catalysts, average ammonia levels measured in the exhaust during transient and steady-state testing were 6 ppm or less after engine aging these systems for 6000 hours.[4] The commenter stated that in the case of performance measured over the Federal heavy-duty transient test cycle, both of these aged systems showed ammonia slip levels of less than 1 ppm on average across the transient test cycle.

MECA further commented that, as cited by EPA in the Draft RIA, closed-loop control of SCR systems is now being developed for U.S. light-duty and heavy-duty diesel vehicles and will be introduced into the market between 2008 and 2010. The commenter noted that these closed-loop control systems will operate under conditions that maximize NOx conversion efficiencies while minimizing ammonia slip. Additionally, the commenter noted that catalyst manufacturers have available and continue to develop ammonia slip catalysts that can be placed after the SCR catalyst to selectively convert ammonia to nitrogen. (The commenter noted various SAE papers in its comments regarding ammonia slip catalysts.)

Finally, MECA commented that DOCs are a well proven, durable catalyst-based technology that have accumulated millions of miles of service on light-duty and heavy-duty vehicles. The commenter stated that, in particular, the ability for DOCs to oxidize NO to NO_2 is a critical pathway to the soot regeneration characteristics of catalyst-based DPFs that rely on the passive regeneration of soot. In some designs, these catalyst-based DPFs include a DOC upstream of either an uncatalyzed or catalyzed wall-flow ceramic filter. The commenter noted that literature on this issue includes numerous references to the use of retrofit catalyzed filters that feature a DOC+DPF configuration where the DOC is used to oxidize NO to NO_2 to facilitate soot regeneration at relatively low exhaust gas temperatures in the range of 200 to 350 °C. MECA also noted that in some cases, these DOC+DPF retrofit passive filters have been in service for many years and hundreds of thousand of miles of operation. (The commenter lastly noted that SAE papers number 2000-01-0480 and 2004-01-0079 are two references that provide evidence that passive soot regeneration facilitated by NO oxidation over a DOC is maintained after many thousands of hours of operation.)

GE commented that with regard to EPA's statement that "emissions of a new engine - and the emissions throughout much of the engine's life - will be closer to 0.8 g/bhp-hr" (Draft RIA, p. 4-30), it agrees that with significant engineering development it will likely be able to achieve a 0.8 g/bhp-hr level in an "as new" configuration in the locomotive environment using the appropriate catalyst. The commenter stated that its point of departure with EPA's view is the

[4] "Demonstration of Potential for Selective Catalytic Reduction and Diesel Particulate Filters," presented by Magdi Khair, 11th DEER Conference, August 2005, online at: http://www1.eere.energy.gov/vehiclesandfuels/pdfs/deer_2005/session5/2005_deer_mcgill.pdf. This document is available in Docket EPA-HQ-OAR-2003-0190.

statement that the engine will be able to maintain that performance throughout its useful life. The commenter stated that it believes that, due to degradation of the catalyst (which has not been adequately accounted for in the proposed rule and which recent studies support), the proposed 1.3 g/bhp-hr level at end of useful life is not achievable.

GE also commented (in Appendix A of its comments) that it is concerned with the long-term achievability of the Tier 4 NOx standard using an SCR system, specifically due to catalyst deterioration. The commenter stated that it agrees with EPA on most aspects of the achievability of the emissions standards in the proposed rule. The commenter stated, however, that it continues to have concerns with the aspect of catalyst durability, specifically related to the ability of the catalyst to achieve 1.3 g/bhp-hr throughout the locomotive's useful life. GE commented that the NPRM was largely based on data that was developed and published generally in the 2005-2006 timeframe, with systems applicable to truck operations using a catalyst that will not perform adequately to achieve the proposed locomotive standards over the useful life. The commenter stated that numerous studies have since been published that further support its concern that the catalyst will deteriorate beyond the 10% rate EPA cited in the NPRM and beyond a rate that allows for compliance with the 1.3 g/bhp-hr limit throughout the locomotive's useful life.

GE also commented that the performance of a typical urea-zeolite catalyst is a function of temperature and is generally ineffective with exhaust gas temperatures below 200 °C but very effective for exhaust gas temperatures above 300 °C. The commenter noted that, given the range of engine operating conditions included in the locomotive test cycle and subsequent range of exhaust gas temperatures, the conversion efficiency of the SCR must be high enough under the conditions for which it is effective to compensate for the conditions where it is ineffective. For the high temperature (above 300 °C) operation, a conversion efficiency of ~84% is necessary to achieve an effective composite duty cycle NOx reduction of 76%. This is the effective duty cycle reduction required to lower engine out NOx from a Tier 2 level of 5.5 g/bhp-hr to the proposed Tier 4 level of 1.3 g/bhp-hr [(5.5-1.3)/5.5 = 0.76]. The need for these conversion levels is illustrated in a table (see OAR-2003-0190-0590.1, p.A-5 for table), for simplicity, the eleven power settings of a locomotive have been collected into three groups of exhaust gas temperature (less than 200 °C, between 200 °C and 300 °C, greater than 300 °C) (assuming normal ambient temperature and pressure conditions). The low temperature exhaust gas (<200 °C) group consists of the four locomotive operating conditions of idle, low idle, dynamic breaking and notch 1. The exhaust gas temperature of Notch 2 is between 200 °C and 300 °C. All of the power settings from notch 3 through notch 8 produce exhaust gas temperatures above 300 °C. As shown in the table, for an engine-out line-haul locomotive duty cycle NOx level of 5.5 g/bhp-hr, the SCR NOx conversion for high temperature operation must be at least 84% to stay under a 1.3 g/bhp-hr level.

EMD commented that, as noted by EPA in the June 25, 2007 industry meeting, aftertreatment applications to turbine engines are difficult because such engines will tolerate only minimal backpressure. The commenter noted that a turbocharged two-stroke cycle diesel engine is similar to a turbine engine, and can be thought of as a turbine engine with a reciprocating combustor. The commenter thus stated that application of aftertreatment devices to two-stroke engines poses many of the same problems seen with application of such devices to turbine engines. The commenter stated that the reason for the difficulties likely to be encountered with aftertreated two-strokes is that there is no pumping done in the cylinders (all of the pumping is carried out by the scavenging blower, in modern engines an exhaust-driven centrifugal compressor which pumps air through a constant orifice in the engine, set by the port sizes and the fact that approximately one-quarter of the cylinders are undergoing the scavenging process at one time). Consequently, the commenter stated, anything that has significant effect on the performance of the turbocharger compressor or its driving exhaust turbine will affect engine performance to a similar degree.

EMD also commented that the problems likely to be encountered from backpressure variation as devices increase soot and ash loading and then are cleaned or regenerated. The commenter stated that such variability increases by an order of magnitude the problems faced by the engine and aftertreatment system designers. The commenter noted that in designing an engine and turbocharger system for variable backpressure, (aside from the loss of performance and fuel consumption from increased backpressure) careful design must be exercised to avoid driving the turbocharger compressor into surge, in which it cannot support the pressure ratio across it and flow through the compressor reverses. EMD further noted that surge can be destructive to both the turbocharger and the engine air filters, located immediately upstream of the compressor. The commenter stated that ways of controlling the backpressure and its variation are likely to include the following:

- Increase of the size of aftertreatment devices—a larger device will provide lower backpressure for the same flow. (The commenter believes that this consideration casts further doubt on the size estimates provided by EPA.)
- Reduction of maintenance intervals for devices—if backpressure increases beyond the ability of regeneration to remedy due to progressive fouling of aftertreatment devices, one possible measure is to require more frequent cleaning or replacement of elements. (The commenter stated that it believes that this is why EPA should not set maintenance intervals for unproven devices, as EPA may inadvertently constrain the process in such a way that no solution is possible.)
- Reduction of the effectiveness of the aftertreatment devices—through increase in cell size, reduction of numbers of cells per square inch, etc.; which would throw more of the burden of emissions reduction back on the engine, increasing engine cost and, likely, fuel consumption.

With regard to temperature concerns, the NJDEP (0562.2) commented that SCR NOx catalyst high temperature hydrothermal exposure limits have improved and low and high temperature SCR NOx selectivity is also improving due to manufacturer development work.

Caterpillar commented that they agree with EPA's assessment that the metal-CDPF technology has some potential to address some of the major questions concerning exhaust filters, but believes that the basic limitation of particulate reduction efficiency must be recognized, and thus efficiencies above 60% should not be assumed for metal-CDPF. They also noted that EPA stated that data from locomotive testing confirms relatively low elemental carbon fraction and relatively high organic fraction for PM emissions from medium-speed Tier 2 locomotive engines, and a system with an oxidation catalyst and a metal CDPF would reduce overall PM emissions from a locomotive or marine diesel by upwards of 90%. The commenter stated that, while true under some operating conditions on some engines, this does not recognize that the locomotive cycles which include operation at idle for 59.8% of the time for switchers and 38% for mainline. The commenter noted that the exhaust temperature is less than 260 °C for idle and throttle notches below 3 for medium-speed locomotives (as noted in EMA's comments on the ANPRM), and the efficiency of a metal-CDPF cannot be extrapolated to smaller high speed engines or to purpose built large marine engines.

Caterpillar also stated that using the high end of aftertreatment efficiency estimates as the generally achievable efficiency will lead to infeasible standards; and further that the metal-CDPFs have not been demonstrated in large size, and scale-up to large units is not trivial. The commenter stated that substantial lead time (several years) is needed to have units designed, built, and tested (and redesigned from field-testing knowledge, if necessary) to have any certainty that these units will function and survive in locomotive or marine applications with 9000 hp or more.

Letters:
Caterpillar OAR-2003-0190-0591.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1
General Electric Transportation (GE)OAR-2003-0190-0590.1
New Jersey Department of Environmental Protection (NJDEP) OAR-2003-0190-0562.2

Our Response:

We agree with EMD that the specific limitations of metallic filter technologies and issues with significant operation of locomotives under idling conditions cannot simply be "assumed away." Quite to the contrary, our Final RIA specifically considers the contribution of emissions from each of the locomotive operating modes (including idle operation) in evaluating the expected performance of a particular filter system. In a similar manner, our analysis in Chapter 4 of the RIA considers the impact of temperature at each locomotive operating mode on SCR NOx catalyst performance. That analysis along with testing conducted by EPA shows clearly that SCR catalysts can meet the 1.3 g/bhp-hr standard over the locomotive test cycle as we are requiring. The urea SCR durability data referred to by the commenter is the same data we analyzed in Chapter 4 of the RIA. There we show that urea SCR catalysts can provide acceptable NOx performance even following catalyst aging at temperatures in excess of the exhaust temperatures encountered even under the most severe line-haul locomotive operational conditions.

EPA has reviewed the studies cited by GE. In some instances, they are identical to studies cited by EPA within the Regulatory Impact Analysis and lead us to conclude that existing SCR technology could be used to meet the 1.3 g/bhp-hr standard at the end of locomotive useful life. We drew considerably different conclusions from these studies. These studies, and other studies both past and more recent, are cited in the both the Draft Regulatory Impact analysis and the Final Regulatory Impact Analysis, show very good NOx reduction efficiencies following hydrothermal aging and engine aging of zeolite-based SCR systems at 600 to 650 °C, which represent exhaust temperatures that are considerably higher than those encountered even under the most severe line-haul locomotive operation. Oil poisoning effects cited by the commenter were limited to catalyst poisoning by ZDP additives at the relatively high additization levels used with the much older American Petroleum Institute (API) CH-4 oil classification used with highway diesel engines in the U.S. and used by the researchers in the study. ZDP additives are not used in Locomotive Maintenance Officers Association (LMOA)-approved locomotive engine lubricants due to incompatibilities with engine bearing materials in some locomotive engines. It should also be noted that CH-4 and CI-4 highway diesel lubricants have been supplanted with CJ-4 lubricants for applications using exhaust catalysts. The newer CJ-4 lubricants, like the current LMOA locomotive lubricants, place restrictions on the zinc and phosphorous additives. In the case of the CJ-4 classification, the limitation placed on zinc and phosphorous additives were specifically added to prevent catalyst poisoning. Similar additive limitations were also placed on lubricating oil formulations for gasoline vehicles following the introduction of catalytic converters to prevent catalyst poisoning.

The issues regarding washcoat adhesion following high temperature aging with urea injection cited by the commenter also appear to be limited to light-duty automotive applications that see considerably higher exhaust temperatures than severe-service line-haul locomotives due to the placement of the SCR system upstream of the DPF system (rather than downstream, as expected with locomotive and marine applications) in order to meet transient cold-start NOx emissions control requirements. The upstream SCR location subjects the SCR system to temperature excursions of up to 800 °C during forced DPF regeneration, and the design also necessitates frequent forced DPF regeneration due to the absence of NOx for passive DPF regeneration. We do not expect this type of catalyst configuration to be used for locomotive (or marine) applications due to the very different operational characteristics of locomotives which are reflected through regulatory emission test cycles that differ radically between locomotives and light-duty diesel automobiles. The much longer 2000 hour aging interval cited by MECA in their comments and other durability data presented in the Regulatory Impact Analysis also points towards excellent catalyst durability at temperatures up to 600 °C for zeolite-based SCR systems. Recent data from EPA testing also shows low hour NOx efficiency for zeolite-based SCR to be considerably improved relative to either the commenter's estimates of low-hour NOx performance and relative to EPA's earlier estimates of low-hour NOx performance presented in the Draft Regulatory Impact Analysis. This testing confirms that the aftertreatment systems can maintain high efficiency at high hours.

GE's comments referenced data in a manner that suggested that frequent changing of a locomotive diesel oxidation catalyst would be required over the life of a Tier 4 locomotive. The data cited showed hydrocarbon fouling of a DOC occurring due to fuel enrichment that was used during cold-start to rapidly heat a catalyst system configuration under development for a light-duty diesel vehicle platform. The commenter failed to note two important factors related to the observed hydrocarbon fouling in their review of the data:

1. Cold-start fuel enrichment for rapid catalyst heating will not needed to meet the Tier 4 locomotive standards since the standards do not require emissions to be measured during a cold start-up procedure as is the case with light-duty automobiles.
2. Even in the case of light-duty automobiles, the hydrocarbon fouling observed by the researchers was completely and nearly instantaneously reversible once the enrichment strategy was disengaged and the engine was returned to normal fuel management.
3. EPA testing confirms the ability to maintain $NO:NO_2$ oxidation at high hours and after exposure to high temperatures and high levels of lubricating oil contamination.

Regarding the EMD comments about exhaust backpressure, we have concluded that a properly-designed partial-flow DPF can provide less pressure variation as soot loading changes (between fully-clean and fully-loaded) than a wall-flow DPF. As discussed in Chapter 4 of the RIA, we believe that the PM standards are achievable using a partial-flow DPF, and expect that some marine and locomotive manufactures will choose partial-flow DPFs while others choose wall-flow DPFs. For wall flow-DPFs that require "active" regeneration, the effect of soot accumulation within the filter (and the resulting increase in exhaust backpressure) can be reduced by implementing a strategy of more-frequent regeneration events (i.e., regenerating the filter whenever there is an opportunity instead of waiting until the filter is fully loaded). For DPFs which rely on "passive regeneration", where NO_2 created by the DOC is used to oxidize the soot, proper sizing of the DOC and selection of a proper washcoat formulation can assist in reducing backpressure variation. If the turbocharger design is matched to the worst-case backpressure scenario (a fully-loaded filter), compressor surge should not occur.

Concerning the comments from EMA and Caterpillar about the limitations of metal-CDPFs, our analysis of PM conversion efficiency at full useful life (detailed in section 4.3.1.2 of the Final RIA) – with no conversion expected in idle-Notch 1, 60% conversion in Notch 2, 85% conversion in Notches 3 and 4, and 83% conversion in Notches 5-8 – is comparable to the commenter's analysis, with one exception. In Notch 2 operation, we use the exhaust gas temperature of 270 °C, which is supported in the 2005 AAR In-Use test data recorded on a Tier 2 GE locomotive. At 270 °C, we believe that a conversion efficiency of 60% in Notch 2 is possible, and a cycle-weighted, overall efficiency of 55% to 60% is feasible with a metal-CDPF. The 60% trapping efficiency takes into account only soot trapping, not oxidation of semi-volatile organic PM. Oxidation of semi-volatile organic PM contributes more to overall PM efficiency of a metal-CDPF for locomotive and category 2 marine applications due to the larger contribution of semi-volatile organic PM to total PM emissions.

EPA's estimate of PM emissions was not only at specific operating conditions. The calculations of PM efficiency took into account the entire regulatory cycle (line-haul and switch for locomotives, E3 for marine) along with calculations of sulfate-make, soot trapping efficiency, and oxidation efficiency for semi-volatile organic compounds. For example, Figure 4-18 in the Draft Regulatory Impact Analysis showed calculated PM removal efficiency versus temperature for all eight loaded locomotive throttle notches and for operation at both idle conditions and dynamic brake conditions. As shown in the figure, the calculated PM removal drops to near zero at light load conditions below the light-off temperature of the semi-volatile organic species in the exhaust, which account for nearly all of the PM emissions for medium-speed engines at very low equivalence ratio/light load. PM removal efficiency also drops somewhat above 300 °C due to oxidation of fuel and lubricant sulfur over the PGM catalyst to form sulfate PM. The 90 % PM reduction for Tier 4 relative to Tier 2 includes a 50% reduction in engine-out PM going from Tier 2 to Tier 3, and then the application of catalytic controls for a cycle-average reduction of 60 to 70% when going from Tier 3 to Tier 4 technology.

The commenter's reference to engines in excess of 9000 hp is largely irrelevant. Current Tier 2 diesel electric locomotives in the U.S. do not exceed 4500 hp. Limited numbers of 6000 hp Tier 0 locomotives were produced in the past but are no longer offered. Marine engines above 9000 hp are nearly entirely Category 3 engines with cylinder displacements greater than 30 liters/cylinder. Among Category 2 marine engines produced and sold by Caterpillar, only the Tier 1 Caterpillar 3618 is over 9000 hp (9652 bhp rating). The Caterpillar C280-16 Category 2 marine engine has a continuous rating below 7200 bhp and the higher power Caterpillar/MAK M32C and M32CV marine engines exceed 30 liters/cylinder and thus are Category 3 engines that are not subject to the Tier 3 and Tier 4 standards.

After considering all of the issues specific to locomotive operation raised by the commenters, we continue to conclude that a Tier 4 PM emission standard of 0.03 g/bhp-hr and a Tier 4 NOx standard of 1.3 g/bhp-hr are feasible in the timeframe required by our final rule.

10.2.8 Size, Weight, and Packaging Concerns in Locomotive Applications

What Commenters Said:

AAR commented that the space available on a locomotive for DPF and SCR systems is extremely limited. The commenter noted that railroad tunnels, stations, and other features of the railroad right-of-way make it impossible to build wider locomotives, and longer locomotives would not be able to navigate the right-of-way. The commenter stated that it believes that the space available on locomotives today would not accommodate both a DPF and an SCR system, which are projected to take up more than 40 cubic feet. The commenter stated that weight is also a concern. The commenter noted that locomotives must be heavy enough for traction, but not so heavy as to damage track or cause derailments. AAR provided the example that hybrid line-haul locomotives likely will need smaller fuel tanks to reduce the weight of the fuel transported in the locomotives because of the weight of the batteries. The commenter noted that the aftertreatment devices contemplated by EPA are projected to weigh more than 8,000 pounds, and stated that it believes that weight could be problematic.

NJDEP commented that, with regard to the request for comment on the effect on locomotive weight and balance of DPF + SCR weighing 8,000 lbs with 40 cubic feet of volume when mounted above the engine, replacing the muffler provides the best location for placing the DPF + SCR systems without affecting the plane of locomotive weight distribution.

EMA noted that available space for aftertreatment in locomotives is severely constrained by engine and generator size and by the other necessary equipment that must be included to make a functioning locomotive. The commenter noted that a locomotive's outer dimensions are strictly constrained; the overall width and height and overall cross-sectional shape are limited by clearance requirements to pass under bridges and other structures, through tunnels, and next to trains on parallel tracks. The commenter noted that overall length is constrained by the need to keep clear of passing trains on curves. EMA further noted that operational requirements for switchers and lower-power main-line locomotives, such as minimum track radius for operation and track-per-axle weight limits, cause external size constraints to be even more restrictive than for the high-power 6-axle mainline locomotives. The commenter also stated that the difficulty of finding space for aftertreatment systems increases as locomotive power increases, due to the increasing aftertreatment size as engine power increases (the required aftertreatment size is approximately proportional to engine power). Additionally, the commenter stated, the cooling system requirements increase as engine power increases, which in turn causes the size of heat exchangers to increase as well.

EMA also commented that the aftertreatment size also depends on allowable backpressure. The commenter noted that the NPRM appeared to base some assumptions regarding aftertreatment systems on a simple scaling of aftertreatment size from on-highway applications. The commenter stated that it believes that this leads to an underestimation of the size of the aftertreatment systems needed for locomotive applications, as the backpressure allowed on large locomotive engines is less than on on-highway engines due to requirements to keep exhaust temperatures low to protect internal components. The commenter noted that component cooling is an increasing issue as component size increases. (E.g., the case of head cooling where, for a larger engine, the head deck must be made thicker to withstand the cylinder pressure as the bore size is increased. The thicker head deck makes cooling more challenging since the combustion surface temperature must be kept to the same limits.)

EMA further commented that locomotive weight is also constrained, axle loading is limited by rail capability, and bridge capacity is another overall constraint. The commenter stated that on-board storage of urea must recognize the inherent limits imposed by these fundamental weight constraints; the size and weight of the urea SCR system depends on the emission reduction required. The commenter stated that, in that regard, the NOx limits for locomotives should not be reduced below the levels set forth in the NPRM, since any additional stringencies would make an already difficult packaging task infeasible. The commenter stated that it does not believe that sufficient space exists in locomotives at current power ratings for the aftertreatment required to meet even the proposed limits. EMA commented that, overall, it remains concerned that the many difficulties involved in implementing aftertreatment requirements for locomotives have not been fully addressed.

EMA also commented that an additional major concern relates to the amount of urea that must be carried on-board. The commenter stated that requirements to store urea on-board in quantities significantly greater than the amount of urea needed to cover the total fuel usage on-board would seriously affect the practicality of deploying SCR. The commenter noted, for instance, that if future guidance documents required carrying enough urea to last until emission equipment service intervals, urea SCR would be completely infeasible. The commenter stated that in locomotive applications, for example, urea storage requirements to ensure that urea lasts until the 90-day inspection event would be excessive, requiring approximately 30,000 pounds of urea, greatly exceeding the additional weight that most locomotive designs could be expected to manage.

EMD commented that it retains significant concerns on size and weight of aftertreatment devices for NOx and particulate matter, and believes that EPA has underestimated their required size by half (and overestimated the space actually available on a locomotive). The commenter noted that tunnel operation poses significant challenges to aftertreatment devices, beyond simply operational temperature; and suggested that in EPA's tunnel tests the soot emissions from locomotives in tunnels should be evaluated. The commenter noted that the maximum height and width dimensions of locomotives are set by a modified AAR Plate "C," which limits locomotives to sixteen feet one inch high by ten feet eight inches wide. The commenter noted that freight cars that are taller than locomotives and are limited to certain routes, while a locomotive must be able to go everywhere on the system. The commenter also noted that the maximum length of a locomotive is limited to approximately eighty feet by curving considerations; longer locomotives overhang the track excessively on curves, and potentially can foul cars and locomotives on adjacent tracks. Lastly, the commenter noted that the weight of locomotives is limited by the maximum allowable axle load, with existing roadbed and bridge systems 35 tons per axle, or 420,000 pounds for a six-axle locomotive.

EMD commented that modern freight locomotives are up against all of these constraints. The commenter noted that increased power, and increased tractive effort due both to increased power and to improved wheel slip control, have necessitated sufficient extra structure in locomotives that meeting the 420,000 pound weight limitation is a challenge. EMD also commented that a locomotive has to carry its own fuel for its operational range. The commenter noted that a modern high-horsepower locomotive has a 5000 gallon fuel tank capacity, and fuel alone accounts for over 35,000 pounds of the locomotive's weight. The commenter further noted that the crew has to be able to pass between the locomotives in a multiple-unit consist, and has to be able to see along the units to monitor the train (for example to detect dragging equipment, shifted loads, or hotboxes), thus the walkways must be kept clear. Additionally, the commenter noted that the locomotive design has to allow space for maintenance (e.g., the space above the engine has to be kept clear to allow for in-service replacements of failed power assemblies) and for the crew and crew amenities, such as toilet facilities. The commenter raised the concern that much of the little space that might appear to be available on a locomotive is already taken up for other uses.

EMD commented that, in addition to the weight of aftertreatment devices, the weight of the structure to support them must be considered. The commenter stated that such devices would, of necessity, be mounted high in the locomotive, above the engine and exhaust turbo charger; but the engine and turbo charger are not designed to support several tons of machinery. The commenter stated that structure would have to be added to the locomotive to support aftertreatment reactors, and would have to be designed to withstand the longitudinal impact loads imposed by slack action in the train and hard coupling events, and the lateral accelerations imposed by rough track. The design criterion for such loads is five times the acceleration due to gravity. EMD commented that it is also concerned about the space required for any necessary reductant for NOx aftertreatment systems. The commenter noted that if, for instance, the reductant usage is five percent of the fuel use, space and weight allowance must be found for at least 250 gallons of reductant (otherwise, the use of fuel as reductant will reduce the locomotive's range).

EMD commented that it does not share EPA's confidence expressed in the NPRM that there is adequate space on our locomotives to package SCR and DPF components as presently envisioned. The commenter also noted that the available space on a locomotive is that occupied by the exhaust silencer (if one is fitted), and the other apparent space on the locomotive must be left empty to serve the maintenance and crew purposes described above. The commenter noted that the exhaust silencer occupies a volume of approximately 35 cubic feet, and the diesel particulate filter with which EMD has been carrying out early investigations has 47 cubic feet of elements alone, without accounting for necessary ductwork to lead exhaust from the engine to the elements, distribute the exhaust over the faces of the elements, and collect the filtered exhaust and lead it out of the locomotive or to the SCR reactor, for which there is no space once the DPF has been installed.

EMD commented that even the solution for a Tier 4 EMD 16-710G3C that EPA put forth, which utilizes exhaust manifold space to mount a diesel oxidation catalyst and uses a partial-flow DPF and an SCR reactor using a zeolite catalyst, does not meet the space requirements. The commenter stated that the total volume estimated by EPA to be required by the DPF and SCR is the 35 cubic feet available. The commenter noted that EPA has stated that there would be additional space required for the SCR dosing grid, urea mixing, for transitions between components, and for any elbows required for inertial separation and collection of ash from a partial-flow DPF; however, the commenter stated that for these latter items, there is no space on the locomotive. The commenter further stated that it believes that EPA's calculated space requirements appear to understate the actual case (see the table at OAR-2003-0190-0594.1, p. 20). The commenter noted that EPA's analysis cited the AAR Plate "L" clearance diagram, however, the commenter noted, locomotives meeting AAR Plate L are restricted from some areas of the North American railway system (such as notably the Northeast Corridor). The commenter noted that in order to be able to be used everywhere on the system, locomotives must meet a modified AAR Plate C clearance diagram. The commenter further noted that the Plate C clearance diagram requires locomotives to be notably narrower (ten feet eight inches versus eleven feet five and three quarters inches) and somewhat lower (sixteen feet one inch above top of rail versus sixteen feet three inches) than would be the case under Plate L. The commenter stated that locomotives therefore must occupy a smaller envelope than that assumed in EPA's analysis; and suggested that more analysis and discussion are required. The commenter further stated that, given the major concerns surrounding this issue, more discussion is warranted (than the one page in the DRIA).

<u>Letters:</u>
Association of American Railroads (AAR) OAR-2003-0190-0566.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1
New Jersey Department of Environmental Protection (NJDEP) OAR-2003-0190-0562.2

Our Response:

Our projection for catalyst/component volume was based on assigning a "reasonable" space velocity (one which provided a good balance between emissions reduction and exhaust backpressure) to each component – $120{,}000^{-hr}$ for the DOC, $60{,}000^{-hr}$ for the DPF, and $40{,}000^{-hr}$ for the SCR. In our analysis, we used engine data from AAR's locomotive in-use emissions test program to calculate the exhaust flow rate in units of "standard" cubic feet per minute (or SCFM, the conventional unit for volumetric flow used by catalyst manufacturers to calculate space velocity). In EMD's analysis, the "actual" exhaust flow rate was used instead of one corrected to "standard" flow conditions. For consistency in the evaluation and comparison of catalyst volumes, the actual exhaust flow rate of an engine is corrected to standard flow conditions. This method is the accepted practice in the catalyst industry, and is the appropriate method to use when sizing exhaust aftertreatment devices. EMD's method of analysis resulted in a flow rate which was approximately twice that of the value used in the EPA analysis, resulting in a space velocity which was two times greater as well. Once corrected to "standard" conditions, the commenter's results for space velocity (and by extension, component volume) are very close to the EPA analysis. Similarly, EMA notes that catalysts have been sized similar to truck engines which they conclude may be too small (too restrictive to exhaust flow) for locomotive applications. What EMA's comment fails to recognize is that the catalyst size in proportion to the locomotive exhaust flow is almost twice that of an on-highway truck. This is because the comparative sizing done by EMA is based on engine displacement (engine size) while exhaust flowrates are determined by a combination of engine size, intake boost pressure and engine speed. Because rated speed for on-highway truck engines are about twice that of locomotive diesels, the actual volumetric flowrate of a locomotive engine after considering the size difference is about half of that of a truck. Hence, the exhaust backpressure predicted based on on-highway trucks is much higher than what we would project for locomotive engines given their lower volumetric flowrate for the same engine displacement.

The EPA analysis of packaging, described in 4.3.3 of the RIA, is predicated on all aftertreatment components and associated hardware fitting within the AAR Plate "L" profile for locomotives and equipment. Our analysis, as well as a complete system design done by a major exhaust system integrator (Tenneco Automotive), shows that there is adequate space/clearance available in today's 4400-HP Tier 2 locomotives, and indicates that the technologies needed to meet the aftertreatment-forcing Tier 4 standards can be packaged in future locomotives. Since the EPA packaging analysis did not utilize the width available in Plate L – and the height above the top rail is only 2 inches shorter – the dimensional differences between Plates L and C do not have a significant impact on the outcome of our analysis. Our analysis of the packaging did not assume that urea storage tank(s) or aftertreatment components would encroach on existing walkways or crew areas. Furthermore, our analysis (detailed in the Chapter 4 of the RIA) shows that the space above the engine can accommodate the packaging volume necessary for the projected Tier 4 emissions systems. While placement of aftertreatment devices within this space may require some changes to current maintenance practices, it should not require their complete removal to accommodate power assembly replacement.

While existing turbochargers and locomotive hoods may not be designed for "structural" loads (in the sense that they can support the weight of aftertreatment devices), they can be re-designed – or structures can be added - to support such loads. Concerning onboard reductant, we are not requiring that locomotives be designed to maintain any specific amount of urea onboard. Manufacturers will be free to design urea systems to have refill intervals appropriate for the market. However, we expect that the most likely approach will be design the urea systems to need refilling at the same schedule as the fuel tanks. Since a 32.5% urea/water solution weighs approximately 9 lbs/gal, and 250 gallons (5% of the typical fuel capacity of a line-haul locomotive), this amount of urea solution would weigh approximately 2,250 lbs. We believe the weight increase due to onboard reductant, component re-designs, and aftertreatment support structures will not cause a locomotive to exceed the 420,000 lb. weight limitation. The additional weight due to installation of aftertreatment components can be mitigated through the use of computer-aided design techniques to minimize the weight of supporting structures and by taking advantage of weight savings elsewhere in the locomotive through the use of lighter-weight materials in place of steel.

EPA does not agree that the only space available for packaging aftertreatment components is the silencer, or that the space above the engine must be left completely open (as it is today) for maintenance purposes. As described in 4.3.3 of the RIA, and shown in Tenneco's aftertreatment system design (RIA Chapter 4, Figure 4-21), there is space above the engine (a trapezoidal cross-section) that can be utilized for aftertreatment components while preserving the clearance needed to facilitate power assembly removal. We believe that adequate space exists above the engine to accommodate the necessary components and preserve the "maintainability" of the engine.

Partial-flow DPFs should not require inertial separation/collection hardware – accumulated ash can migrate through the device and pass through the SCR catalyst.

10.3 Tier 3 and Tier 4 Marine Standards

10.3.1 Lead-Time for Marine

What Commenters Said:

EMA commented that it believes that the proposal compresses the lead time and stability periods for the proposed standards to the very limit of feasibility, and so establishes the earliest possible effective dates for imposing Tier 3 and Tier 4 requirements on marine engines. The commenter further noted that it believes that, in certain respects, the NPRM provides what in other circumstances would clearly amount to insufficient lead time. The commenter pointed to MECA's public hearing testimony noting that MECA confirmed that the workloads facing engine and aftertreatment system manufacturers, together with the time that is necessarily involved in transferring emissions technologies from one industry segment to another, preclude the deployment of aftertreatment systems for marine engines until 2015 at the earliest. EMA commented that it believes that it is thus clear (and confirmed by third-party experts) that any tightening of the proposed implementation dates for the Tier 3 and Tier 4 standards would necessarily result in an infeasible and therefore non-implementable rulemaking. The commenter further stated that it is concerned that the proposed regulatory framework and implementation dates threaten to cross over the boundary of feasibility in setting the timing of the standards that will apply to certain locomotive engines. EMA also requested that EPA clarify that the proposed engine repower requirements - the requirement to use current tier engines when repowering an existing vessel - will not carry over to Tier 4 engines. The commenter noted that aftertreatment systems anticipated for Tier 4 engines (including large DPFs, SCR systems, exhaust extensions and piping, plus necessary urea tanks and packaging equipment) cannot be retrofitted into existing vessels without incurring extreme and disproportionate redesign and reconstruction costs.

Letters:
Engine Manufacturers Association (EMA)   OAR-2003-0190-0545, 0575.1

Our Response:

We have worked extensively with the Engine Manufacturers Association, its members, and a range of marine industry stakeholders to develop a Tier 3/Tier 4 marine emissions control program that gets the maximum achievable emission reductions possible giving appropriate consideration to the lead time necessary for manufacturers to introduce this new technology. In general, we have not changed the implementation dates for Tier 3 and Tier 4 marine engines from those that EMA commented on at the proposal. However, EMA's comments – and our discussions with them – did result in one significant change that we have made with regard to some of the largest marine engines above 2,000 kW rated power. In that particular case, we have decided to advance the start date for the Tier 4 NOx program to 2014 while at the same time eliminating the Tier 3 NOx control step for these same engines. As described in section 3 of the preamble, this will allow for a significant improvement in air quality sooner while simplifying the development timeline for these engines. The elimination of the Tier 3 NOx control step will provide manufacturers with adequate time to develop and introduce the Tier 4 NOx control step in 2014.

We agree with commenters that raised concerns regarding the application of Tier 4 emission standards to existing vessels. Under our proposed program if the owner of an existing vessel chooses to repower with a new engine, we would have generally required that the new engine meet the latest emissions standards up to and including the Tier 4 standards. Giving consideration to the fixed design of existing vessels and our expectations that Tier 4 emissions control systems will need to be considered within the vessel design, we have concluded that it would not generally be possible to repower existing vessels with Tier 4 engines. We are therefore finalizing an approach as described in section IV.C of the preamble to the final rule that would allow the repowering of existing vessels with previous Tier engine systems.

10.3.2 Stringency of Marine Standards

What Commenters Said:

EMA commented that engine manufacturers agree with and support EPA's conclusion that Tier 4 standards, if adopted, should be limited to large commercial marine applications. The commenter stated that the relevant vessel design and engine installation constraints make it infeasible or extremely impractical to install aftertreatment systems in recreational or smaller commercial marine vessels. The commenter noted that in reaching the overall conclusion regarding the inherent constraints on the application of aftertreatment systems to marine engines, it previously developed a series of matrices to identify those types of marine vessels where aftertreatment might be feasible. EMA noted that the matrices (see Appendix A, OAR-2003-0190-0577.1) list the critical characteristics that marine engine manufacturers must account for when considering the use of aftertreatment systems, such as urea SCR systems or DPFs. The commenter noted that the critical characteristics evaluated in the matrices stem from engine manufacturers' knowledge of vessel types, installations, and usage. The commenter also noted that there are no vertically integrated manufacturers in the marine industry, therefore, the commenter suggested that for various items covered in the matrices, it is recommended that EPA seek additional information from the other key stakeholders impacted by this rulemaking, including vessel designers, builders, owners, and operators.

<u>Letters:</u>
Engine Manufacturers Association (EMA) OAR-2003-0190-0577.1

Our Response:

We received comments regarding our proposal to limit the application of the Tier 4 emission control technologies to commercial engines above 600 kW and recreational above 2,000 kW (see section 3.2.1.2 of this Summary and Analysis of Comments document). Some commenters, such as EMA, concurred with our analysis showing that choosing such a power cutpoint for the application of Tier 4 was an appropriate way to address the numerous technical challenges to the application of Tier 4 emission control systems to small vessels. Other commenters, most notably State and environmental organizations, argued that the Tier 4 standards should apply to marine engines as small as 25 hp. While we agree that even small diesel engines as little as 25 hp can be designed to work with Tier 4 emission control technologies as is required under our Nonroad Tier 4 program, we do not have the same confidence that these systems can be applied to vessels that incorporate water cooled exhaust systems, high power to weight ratios, water injection systems and other unique aspects of marine vessel design as described in Chapter 4 of the RIA and discussed in section 3.2 of this document. Therefore as we explain in section III of the preamble, we have decided to finalize the 600 kW commercial marine cutpoint for Tier 4 engines just as we proposed.

In a change from our proposal, we are not extending the Tier 4 program to recreational marine diesel engines. In our proposal we indicated that at least some recreational vessels, those with engines above 2000 kW (2760 hp), have the space and design layout conducive to aftertreatment-based controls and professional crews who oversee engine operation and maintenance. This suggested that aftertreatment-based standards would be feasible for these larger recreational engines. While commenters on the proposal did not disagree with these views, they pointed out these very large recreational vessels often travel outside the United States, and, for tax reasons, flag outside the U.S. as well. Commenters argued that applying Tier 4 standards to large recreational marine diesel engines would further discourage U.S.-flagging because vessels with those engines would be limited to using only those foreign ports that make ULSD and reductant for NOx aftertreatment available at recreational docking facilities, limiting their use and also hurting the vessel's resale value.

In general, we expect ULSD to become widely available worldwide, which would help reduce these concerns. However, there are areas such as Latin America and parts of the Caribbean that currently do not plan to require this fuel. Even in countries where ULSD is available for highway vehicles but not mandated for other mobile sources, recreational marinas may choose to not make ULSD and reductant available if demand is limited to a small number of vessels, especially if the storage and dispensing costs are high. To the extent the fuel requirements for Tier 4 engines encourage vessel owners to flag outside the United States, the results would be increased emissions since the international standards for these engines are equivalent to EPA's Tier 1 standards.

After considering the above, we conclude that it is appropriate at this time to hold recreational marine diesel engines to the Tier 3 standards. We plan to revisit this decision when we consider the broader questions of the application of our national marine diesel engine standards to engines on foreign vessels that enter U.S. ports in the context of our Category 3 marine diesel engine rulemaking.

10.3.3 Technology Transfer to Marine From Other Sectors

What Commenters Said:

EMA noted that emission control technologies for marine engines are derived from other nonroad engine applications, which in turn are derived from on-highway applications. The commenter noted that at each link of this technology transfer, the increasing complexities of machines and operating environments pose major obstacles to any wholesale transfer of advanced emission control systems, and therefore necessarily prevent a one-to-one transfer of the upstream emission standards. EMA also suggested that EPA ensure that the final rule accounts for any requirements that classification societies (e.g., U.S. Coast Guard, American Bureau of Shipping (ABS), etc.) may establish with respect to the exhaust aftertreatment systems that are expected to be deployed in marine vessels for Tier 4 compliance. The commenter noted that when those requirements are developed, the stringency, costs, and overall impacts on the design and manufacture of marine engines and vessels of the proposed Tier 4 standards may need to be adjusted. EMA suggested that EPA engage in additional outreach efforts with all key stakeholders in finalizing the rule.

MECA commented that it strongly believes that many of the emission control technologies and strategies that are either in or nearing commercial use for meeting the Tier 2 light-duty diesel vehicles standards, or are commercialized or under development to meet the Tier 4 nonroad diesel standards will be applicable to locomotive and marine diesel engines in the 2015 timeframe to meet the proposed Tier 4 locomotive and marine diesel emission standards. MECA also noted that SCR technology using a urea-based reductant has been safely installed on a variety of marine applications in Europe since the mid-1990s on engines ranging from approximately 450 to over 10,000 kW. The Port Authority of New York and New Jersey has recently conducted a pilot project to demonstrate diesel emissions reduction technologies on a ferry retrofitted with DOC+SCR systems on its two main, four-stroke propulsion engines. The commenter noted that emissions testing showed NOx reductions that typically exceeded 94% during ferry cruise modes. The commenter stated that it believes that this project, and other operational marine SCR installations, provides firm evidence that SCR systems can be engineered to meet rigorous marine industry safety standards. The commenter further noted that some of these marine SCR systems have been operating since the 1990s with no reported safety-related issues. MECA commented that as discussed in the EPA technical feasibility document, SCR catalyst formulations based on vanadia-titania and base metal-containing zeolites have been commercialized for both stationary and mobile source applications. The maximum NOx conversion window for SCR catalysts is a function of composition. Base metal zeolite SCR catalysts, in particular, are being developed for applications that require NOx performance and durability under higher exhaust operating temperatures that may be encountered in some mobile source applications. Recent results, published by engineers from Ford Motor Co. at the SAE 2007 World Congress (SAE 2007-01-1575) detail performance characteristics of base metal zeolite SCR catalysts under consideration for mobile source applications on cars and trucks. The zeolite SCR catalysts in this study maintaine1d peak NOx conversion efficiencies of more than 90% over a broad inlet exhaust gas temperature window after hydrothermal aging in a simulated diesel exhaust for 64 hours at 670°C. For low temperature NOx conversion efficiency, emission control system design engineers have a number of options available including the composition of the SCR catalyst itself, control of the ratio of NO_2 to NO present at the inlet of the catalyst, and improving the urea decomposition process at low exhaust temperatures.

Caterpillar commented that it agrees that NOx aftertreatment using SCR has been demonstrated sufficiently to apply to many marine applications at some point, based on strictly technical considerations of engine and aftertreatment issues. The commenter also stated that it agrees that NOx reductions of up to 80% are feasible under limited conditions. The commenter stated that it does however have concerns about the details of applying this technology from an engine/aftertreatment system standpoint, and from the requirement of applying these in a variety of applications. The commenter stated that it believes that SCR is not viable in all cases from a vessel builder or operator standpoint; noting that even after extensive redesign, many vessels will not be able to provide the additional space or to accommodate the additional weight without seriously compromising vessel capabilities. The commenter stated that, fundamentally, requirements to keep the exhaust flow at acceptable temperatures to the SCR inlet will be challenging and may not prove to be feasible in all cases. The commenter suggested that EPA should reach out to vessel builders and architects to help provide this assessment.

The Passenger Vessel Association (PVA) commented that Tier 4 emission reductions are based on land-based technology that has not yet been shown to be adaptable to the rigors of some types of marine service. The commenter stated that it believes that the total operating experience for post-combustion emissions control in the marine environment is very limited and not yet supportive of the optimism reflected in the Tier 4 timelines in the NPRM.

<u>Letters:</u>
Caterpillar OAR-2001-0190-0591.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1, 0545
Manufacturers of Emission Controls Association (MECA) OAR-2003-0190-0494, 572.1
Passenger Vessel Association (PVA) OAR-2003-0190-0576.1

Our Response:

As EMA's comments note, we have worked with EMA and others in the marine industry in considering these factors before making our proposal to set the stringency and implementation dates of the Tier 3 and Tier 4 locomotive and marine standards. Subsequent to our proposal, we have continued to meet with representatives of the various marine industry stakeholder groups in order to ensure that concerns of all stakeholders are considered. As explained in sections III and IV of the preamble, we have made a number of changes and clarifications in the final rulemaking to address the concerns of these groups, including the use of Tier 4 engines for vessel repower, and the procedure that we will use when considering issues of vessel safety and engine design. We appreciate EMA's recommendation that we have extensive outreach with all members of the marine community, and we have followed through on that recommendation.

Regarding EMA's suggestion that the final rule account for any future requirements that classification societies establish with respect to exhaust aftertreatment devices, the Agency cannot anticipate what those requirements may be, but is prepared to deal with them as they arise.

We received numerous comments showing that advanced Tier 4 emission control technologies have been successfully applied in specific marine applications throughout the world. The comments also shared specific issues with these applications for example with regard to operation under low exhaust temperature conditions. We have used this information in our evaluation of the Tier 4 technologies detailed in Chapter 4 of the RIA including our analysis of performance under operating conditions above and below the range of appropriate application for urea SCR based NOx control.

There has been considerable experience with post-combustion emission control systems in the marine environment, particularly in Europe. To date, we are aware of 390 engine installations of SCR that have been installed into 95 marine vessels. For the 2007 calendar year, 4 additional vessels with 22 engines have been scheduled for installation of SCR aftertreatment systems (see Docket ID EPA-HQ-OAR-2003-0190-0737). The number of vessels which are currently using (or will soon be using) SCR technology indicates these emission control systems are adaptable to the rigors of a marine environment.

10.3.4 Long-Term Durability of Marine Aftertreatment Technologies

What Commenters Said:

The City of Vallejo, Baylink Ferries urged EPA to reconsider the reliability, durability, and cost factors for the use of diesel exhaust aftertreatment (SCR) as a means to achieve Tier 4 standards. The commenter noted that the City of Vallejo operates the M/V SOLANO, the only high-speed passenger ferry with SCR installed. The commenter urged EPA to consider the information in the report attached to its comments (OAR-2003-0190-0581.1) and to visit the SOLANO for the purpose of gaining a better understanding of how these systems have performed, and how these systems will impact the vessels.

Letters:
City of Vallejo, Baylink Ferries OAR-2003-0190-0581

Our Response:

The commenter provided a detailed report summarizing a myriad of significant technical issues experienced on the M/V SOLANO - a high-speed passenger ferry with a urea SCR catalyst system installed. While the SOLANO report documents that urea SCR catalysts can be highly effective at controlling NOx emissions on a marine application, and that it is possible to package a large catalyst based emission control system on a high power to weight ratio vessel like a high speed ferry, it also highlights a number of shortcomings of this particular installation. Specifically, the report shows that the SOLANO has experienced significant failures of the catalyst mounting system due to corrosion and subsequent structural collapse. The experience of the SOLANO project certainly serves as a cautionary tale regarding the application of new technology with limited lead time and reflects the experience that unfortunately some early adopters of technology occasionally realize. We have reviewed the SOLANO experience and considered it in our overall review of the appropriateness of applying Tier 4 emission control technologies to marine applications. In aggregate, it leads us to continue to conclude that Tier 4 technologies can provide dramatic emission reductions in marine applications and that emission standards predicated on the application of these technologies should occur in the 2014 or later timeframe required in our final rule.

10.3.5 Expected Performance of Marine Aftertreatment Technologies

What Commenters Said:

With regard to the statement in the NPRM that passive regeneration occurs at 250°C, GE commented that it believes that effective passive regeneration depends on a number of parameters, but generally requires considerably higher temperatures (approximately 400°C) for catalyzed filters. The commenter noted that, for marine applications, reliable regeneration must always occur and there is little room for error for occasional failed regenerations. The commenter stated that it believes that the lower temperature of 250°C for regeneration that EPA cited is the temperature at which regeneration may occur under the correct circumstances (depending on NO_2 content, soot quantity, and soot distribution), but it is not the temperature required to ensure reliable regeneration for the wide variety of marine engine types at issue. The commenter stated that active regeneration can be achieved by using burners to heat the exhaust when soot has accumulated. The commenter noted that this could result in exhaust temperatures of approximately 1200 °F (650°C) going up the entire exhaust stack, a substantial increase from the current stack temperatures of approximately 850°F (450°C) or lower, and will require extreme care in the design of the stack and insulation system. The commenter further stated that this results in the need for more care in installations and maintenance of exhaust systems than is the case with current vessels.

EMA commented that the use of DPFs in marine applications remains unproven, and is perhaps the core issue relating to the feasibility of the NPRM. The commenter stated that, unlike SCR aftertreatment systems, particulate filter systems for marine engines have not been tested in marine vessels except for a very few publicly-funded demonstration projects in very limited and tightly controlled applications. EMA commented that it thus believes that significant questions remain to be answered concerning the use of particulate filters with marine engines.

The Overseas Shipholding Group, Inc. (OSG) commented that it supports the efforts to reduce emissions from ships, but the commenter raised the concern that the proposed regulations rely on the application of technologies that are not yet developed for the marine environment.

The commenter noted that deliveries of new OSG U.S.-flag vessels stretch to 2012 and it is not clear how the ship building and engine manufacturing industries will meet the requirements.

MECA commented that SCR catalyst performance and durability issues are generally independent of the diesel engine application under consideration. The commenter stated that catalyst performance will be largely a function of inlet exhaust gas conditions of temperature and gas composition, the space velocity that the catalyst operates at, the composition of the catalyst, the levels of potential poisons present in the exhaust stream, and the maximum temperature that the catalyst is exposed to during the full useful life period. The commenter further stated that it believes that these catalyst boundary conditions, although not completely equivalent between locomotive and marine diesel engines, are within the performance windows of existing SCR catalyst formulations.

Letters:
Engine Manufacturers Association (EMA) OAR-2003-0190-0545
General Electric Transportation (GE) OAR-2003-0190-0590.1
Manufacturers of Emission Controls Association (MECA) OAR-2003-0190-572.1
Overseas Shipholding Group (OSG) OAR-2003-0190-0589.1

Our Response:

Several commenters raised issues concerning the application of DPF technologies to marine engines. We believe that there is sufficient lead-time to adequately develop both partial-flow and wall-flow DPFs for marine applications. The challenges facing marine applications of this technology are similar to the challenges that are being addressed for nonroad engines of which many of the marine engines are derivative designs. We see nothing in the design or operational characteristics of marine engines that would cause us to believe that DPFs cannot be used in these applications. The challenge of applying catalytic PM controls to marine vessels is also taken into account within the schedule for implementation and within the stringency of the Tier 4 PM standards. Note that the lead time for Tier 4 contemplates these vessel-specific issues (including the timing of existing orders) and is addressed in greater detail in section 10.2.1, above.

10.3.6 Size, Weight, and Packaging Concerns in Marine Applications

What Commenters Said:

OSG commented that it believes that EPA should recognize the specific issues related to the marine environment. The commenter stated that new designs must account for the installation of aftertreatment equipment considering that space in the stack is limited and additional weight in the vessel has an impact on trim and stability, particularly for retrofit applications where it may not be feasible to install aftertreatment technologies such as scrubbers or SCR.

Argillon LLC commented that it believes that packaging of these systems in the confined areas available will be extremely challenging but is considered to be possible.

EMA commented that it believes that the requirement for urea storage should not exceed the amount required to cover the fuel that is carried on-board, with some modest margin, which suggests an amount this is just slightly above what is necessary to cover the maximum diesel fuel storage capacity of the vessel—essentially, that urea would need to be available at virtually all marine diesel fuel tank filling locations.

EMA also commented that it has concerns about the details of applying this technology to a wide variety of marine applications, as it does not believe that many vessel types will be able to provide the necessary room for SCR systems or account for their additional weight. The commenter further stated that the requirements to keep the SCR inlet exhaust gas temperatures within acceptable ranges will be challenging and may not prove to be feasible in all cases, and SCR systems may have adverse impacts on certain types of vessel decking and hulls. The commenter specifically noted that vessel alloys containing copper are a key area of concern, since urea can dissolve copper even when copper is contained in an alloy. EMA urged EPA to reach out to vessel designers and naval architects to obtain proper feedback regarding those vessel types where it is most probable that SCR systems can be utilized effectively.

Lastly, EMA commented that marine vessels below certain size ranges or outside of standard-power commercial applications lack the necessary space and design flexibilities to accommodate advanced exhaust aftertreatment systems. The commenter noted that systems currently envisioned for marine applications could be as large as the marine engines themselves, and likely will require additional tanks, piping and packaging equipment, all of which will impose very significant space and weight impacts on vessel builders.

PVA commented that one of its primary concerns is Tier 4 wherein the engine will be but one part of the total power installation. The commenter noted that the emission control and aftertreatment of Tier 4 could double or triple the space and weight of considerations during build or rebuild of the vessel. The commenter further noted that in the high speed ferry sector where there is foreseeable growth during this time, weight and volume can be large problems to overcome in design, operating costs, and engine efficiency. The commenter stated that external emissions equipment also brings about maintenance and repair concerns not currently encountered. PVA also commented that it believes that existing high speed ferry/passenger vessels should be permanently capped at a maximum of Tier 3 when repowering. The commenter noted that the current-generation high speed vessels rely on high power, lightweight, managed weight distribution, hull design, and judicious space allocation to achieve speed and economy of operation. The commenter further commented that the addition of large weights and volumetric concerns associated with SCR and DPF in existing hulls is difficult and probably not accomplished without substantial performance degrades such as trim, horsepower, revenue space and weight, shoreline erosion, and economic viability. PVA provided the example that the addition of SCR technology to reduce NOx 50% on one of three sister vessels demonstrated that maintaining speed required an increase in horsepower, higher fuel consumption, the addition of 4 tons of SCR related weight, substantial cost, and the degradation of the operating envelope (trim by the stern, larger wake, and slower acceleration).

The Elliot Bay Design Group commented that for most existing vessels, the Tier 4 requirements of adding the particulate filters and SCRs and the necessary modifications to make them fit would increase the vessel's weight and vertical center of gravity, compromising the vessel's stability. The commenter stated that, as many older vessels are already operating with minimal stability margins, it is concerned that extra equipment may create unsafe operating conditions.

Letters:
Argillon LLC OAR-2003-0515
Elliott Bay Design Group OAR-2003-0190-0486
Engine Manufacturers Association (EMA) OAR-2003-0190-0545
Overseas Shipholding Group, Inc. (OSG) OAR-2003-0190-0589.1
Passenger Vessel Association (PVA) OAR-2003-0190-0507

Our Response:

Several commenters raised concerns about the effect that added weight (due to installation of aftertreatment technologies) will have on vessel performance. We did not propose – nor are we finalizing – a standard which requires the installation of Tier 4 technologies on existing vessels (i.e., the packaging of Tier 4 aftertreatment components is only a concern for new vessel designs). For Tier 4 vessels, the effect of that weight, packaging, and placement of these components will have on vessel performance (e.g., trim, stability, fuel consumption, power requirements, wake, etc.) can be accounted for by the marine architects when designing new vessels. For vessels slated for engine replacement (repower), they will not be required to install Tier 4 engines and their related aftertreatment components – they are only required to install a Tier 3 engine (or a Tier 2 engine, if installing a Tier 3 engine is not feasible). Urea- or reductant-based SCR technology will only be required on new vessels equipped with Tier 4 engines. Based on our discussions with marine architects and review of existing marine SCR retrofit applications, we do believe that new vessels can be designed to accommodate the maintenance, repair, and extra weight of these components, as well as the urea storage and delivery systems. If these new vessels utilize urea-SCR technology, they can be built using appropriate alloys/material for the urea storage and delivery systems.

Concerning urea storage capacity, we expect that storage capacity will reflect the duty cycle and regional characteristics of the area in which a particular type of vessel is expected to operate (i.e., a vessel intended to operate out of ports near major cities could refill with urea at each fuel stop, whereas a vessel operating from a remote port would need greater urea storage capacity).

While stationary powerplant (and some of the early ferry) applications have utilized large volume/low-cell density SCR catalysts to minimize the backpressure increase (or match the backpressure of the existing engine), we expect the new Tier 4 engines and systems will be designed to accommodate more-compact components. These “compact” aftertreatment components can be sized similar to the engine displacement-to-catalyst volume ratios found in the on-highway and nonroad engine designs on which they are based. As discussed in 4.3.3 of the RIA, we expect the volume required DPF and SCR components will be 1.7 and 2.5 times an engine’s total volumetric (cylinder) displacement, respectively.

10.3.7 Vessel Safety

What Commenters Said:

Tidewater Inc. commented that it is also concerned that the addition of exhaust emission treatment equipment into existing vessels’ engine rooms and stack spaces, especially if associated with catalytic converters that may require additional heating, may have acute safety considerations. The commenter noted that engineering spaces, even in current designs, are crowded with equipment. The commenter stated that it believes that any modifications that impact accessibility of areas within these spaces could detrimentally affect a vessel’s ability to extinguish a fire, and/or hazard crewmembers’ lives. The commenter urged that consideration in any proposed rules reflect these implicit dangers, as a fire at sea is a deadly serious matter.

Tidewater also noted that a greater concern for the marine industry and commercial marine vessel operations generally, is the belief that the rules focus on the engines to the exclusion of every other factor including the safety of the vessel and seafarers. The commenter stated that in the past, the older non-electrically controlled engines were robust enough to get the vessel back to port. The commenter stated that today’s electronic engines are more temperamental, require factory technicians to repair, and can leave vessels stranded. The commenter stated that it believes that adding complex emissions equipment will further strain limited crew capabilities and extend work hours. The commenter stated that the NPRM will require additional equipment, piping and storage tanks adding weight and creating stability concerns—which can be addressed in new vessel designs, but the impacts and costs are not understood by the engine manufacturers and are not common to the land-based locomotive industry.

OMSA noted that the preamble states offshore vessels are quite diverse and place a high premium on engine reliability, considering the potentially serious ramifications of engine failure underway (72 FR 15974). The commenter noted that offshore vessels tend to operate from remote locations with limited crew size. The commenter stated that no regulations should be implemented that increases the danger of fire, capsize, or critical system failure. The commenter stated that it believes that the engine exhaust rules proposed will provide a benefit to numerous people; however, prior to implementation of the new standards, the commenter urged EPA to analyze and consider any increase in the risk to life of the mariners operating offshore support vessels. The commenter stressed that EPA cannot increase the risk of one population to benefit another. OMSA urged EPA to study the reliability of marinized designs, the availability of ULSD and urea to the marine market and effect of Tier 3, and Tier 4 ancillary systems on vessel design and operations prior to implementing the standards on vessels.

EMA commented that in the specific case of marine engines, the inherent constraints and demands of the marine environment present very unique and significant challenges. Those challenges, the commenter stated, include the requirements for extreme engine power density in order to bring vessels up to plane or to tow or push heavily loaded ships and barges, the utilization of wet exhaust systems and the resultant potential for sea water contamination, and the especially important requirements for safe and durable operation at sea (which dictate, among other things, very strict limits on the surface temperature of engine and exhaust systems).

EMA also commented that the issue of higher exhaust stack temperatures must be addressed and resolved with due regard to the various extremely sensitive applications that are found in-use, such as vessels that service off-shore drilling platforms. The commenter noted that while EMA does not anticipate that there will prove to be any inherent problems in the integration of aftertreatment systems into commercial vessels powered by engines greater than 600 kW, the possibility of having higher surface temperatures near at hand must be considered, as there may be some specific applications where high exhaust stack temperatures are simply not acceptable. The commenter suggested that provisions may be needed in the final rule to allow vessel owners to apply for an exemption from the Tier 4 aftertreatment-forcing standards for certain sensitive applications where a hazardous environment may be present, such as for those vessels that are classified as Class 1, Division 1 under the rules of the National Fire Protection Association (NFPA). The commenter further suggested that EPA should engage in further outreach efforts with the NFPA and other key stakeholder groups concerned with vessel safety to address this issue.

GE commented that it believes that another issue is the potential overheating of a filter due to carbon build-up and the subsequent oxidation of excessive carbon, or a regeneration with insufficient exhaust flow, which can lead to melting of the filter. The commenter stated that this can cause significant backpressure, which in turn can seriously reduce the power of the engine. The commenter stated that it believes that, due to the extremely high temperatures at issue, there is a potential for burning through the outer surface of the reactor, which could lead to large exhaust leaks and hot outer surfaces. The commenter stated that it is concerned that these issues have not been addressed (nor resolved) for marine applications, and should be a concern for vessel designers, operators, and those that will certify these aftertreatment systems.

EMD commented that it believes that it is paramount to keep in mind that marine applications are very unforgiving. The commenter noted that loss of, or significant restriction in, power is extremely serious in a marine application. The commenter provided the examples that: vessels must be able to be positioned properly to survive large waves in storms; harbor tugs must not suffer power restrictions or the large vessels they are pushing or pulling may not be able to be controlled; Mississippi and Ohio River systems vessels must have enough power to keep a line of up to 24 barges positioned in a curving channel while avoiding bridges and other traffic;

and Great Lakes freighters must be able to run upstream against the current in the Detroit River in a channel that is narrower than the vessel is long. EMD stated that insufficient power to overcome the current would cause extreme difficulties for any maneuvering.

Marathon Petroleum Company LLC commented that it supports EPA's goals of reducing engine emissions in a cost-effective and technologically feasible manner. However, the commenter stated that it believes that it is important for EPA to consider that although engine technology may be developed to lower emissions, it is critical that the technology be able to be marinized and used on vessels while maintaining safety and operational efficiency standards. Marathon commented that it is specifically concerned about the application of aftertreatment-based technology. The commenter stressed the importance of giving consideration to issues like below deck area for installation of aftertreatment technology and the availability of aftertreatment technology chemicals and maintenance facilities. Because of the equipment requirements for Tier 4 technology, the commenter stated, Tier 4 engines should only be required on vessels that are built after the effective date of the Tier 4 standards.

Caterpillar commented that particulate filters continue to be a large unknown for marine applications. The commenter noted that these systems have not been tested in marine applications except for very few units in very limited applications. The commenter noted that EMA's comments on the ANPRM two years ago documented many of these concerns. Caterpillar commented that it believes that EPA has not adequately addressed many of these serious obstacles to applying particulate filters in marine applications, as noted below:

a) Particulate filters can experience filter plugging—they can accumulate soot and create excessive backpressure if regeneration does not occur on a regular basis. Excessive backpressure can substantially reduce the power the engine can produce, thus a reliable regeneration must be available for filters with the potential for plugging to be used in marine and locomotive applications.

b) A loss or significant restriction in power is extremely serious in a marine application: in storms, vessels must be able to be positioned properly to survive large waves; harbor tugs must not suffer power restrictions or the large vessels they are pushing may not be able to be controlled; vessels on the Mississippi river system must have enough power to keep a line of 24 or more barges positioned in the curving channel while avoiding bridges and other traffic; Great Lakes freighters must be able to run upstream against the current in rivers in a channel that is narrower than the vessel is long, insufficient power to overcome the current would cause extreme difficulties for any maneuvering.

c) The commenter noted that EPA has stated that passive regeneration will occur at 250 °C and commented that it believes that effective passive regeneration depends on a number of parameters, but generally requires considerably higher temperature (approximately 400 °C) for catalyzed filters. The commenter also noted that fuel sulfur and lubricating oil ash can degrade the catalyst over time, and that, for marine applications, reliable regeneration must always occur. The commenter stated that there is little room for error for occasional failed regenerations, and raised the concern that the lower temperature of 250 °C for regeneration is the temperature that regeneration may occur under the correct circumstances (NO_2 content, soot quantity, soot distribution), but is not the temperature for reliable regeneration for a variety of engine types.

d) Active regeneration can be achieved by using burners to heat the exhaust when soot has accumulated, resulting in exhaust temperatures of approximately 1200 °F (650 °C). This exhaust going up the entire stack will be near this temperature, and is a substantial increase from current stack temperatures (approximately 850 °F (450 °C) or lower); thus requiring extreme care in the design of the stack and insulation system. This installation and maintenance will need to be done with even more importance than on current vessels.

e) Filter overheating due to carbon build up and subsequent oxidation of excessive carbon, or the regeneration with insufficient exhaust flow, can lead to temperature excursions and melting of the filter. Thus causing significant backpressure which can seriously reduce the power of the engine, also due to the extremely high temperatures the potential exists for burning through of outer surface of the reactor, which could lead to large exhaust leaks and hot outer surfaces. All issues which have yet to be addressed for marine applications. The issue of higher exhaust stack temperatures needs to be addressed from the standpoint of use on extremely sensitive applications such as drilling vessels. The possibility of having a more generally combustible environment near exhaust systems must be considered, as there may be applications where high exhaust stack temperatures are simply not acceptable. Provisions may be needed to exclude certain applications entirely from the aftertreatment requirement.

Caterpillar also commented that, in light of the above concerns, it would certainly participate in and support any future EPA-led review to address whether particulate filters can be successfully applied to marine applications.

<u>Letters:</u>
Caterpillar OAR-2003-0190-0591.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1
General Electric Transportation (GE) OAR-2003-0190-0590.1
Marathon Petroleum Company OAR-2003-0190-0595.1
Offshore Marine Services Association (OMSA) OAR-2003-0190-0611.1
Tidewater Inc. OAR-2003-0190-0557

Our Response:

Several commenters raised the issue of a potential for increased component and exhaust stack temperatures that may occur with the use exhaust aftertreatment technologies. Many comments focused on the DPF, expressing concern that the exhaust temperature increase which occurs during normal soot regeneration and/or un-controlled soot regeneration events will affect vessel safety. While the 650 °C exhaust temperature stated by the commenter for soot regeneration of a DPF may be higher than what is observed on existing engine installations, it is not beyond the temperature observed in nonroad and on-highway engines using DPF technologies. We believe the existing methods for meeting the vessel classification requirements for marine engine component surface temperatures can also be utilized to manage the expected temperature increase due to DPF soot regeneration. In particular, we expect that the heat shielding materials and design practices employed on today's marine diesel engines in flame- and heat-sensitive environments will be used on Tier 4 applications as well (see RIA Chapter 4, section 4.3.2 for an example of exhaust manifold heat shield blankets applied directly to exhaust manifolds). Currently, several 2007 model year, on-highway trucks equipped with DPFs and active soot-regeneration strategies manage the temperature increase of DPF soot regeneration with air-cooled heat shields on the tailpipe. We believe other technologies, such as air-gap construction, or air-gap construction with an outer water jacket, could be used to keep surface temperature below required levels. We believe the knowledge and experience in gained by manufacturers in the areas of temperature management, soot regeneration controls, and reliability of DPFs will directly apply to marine engines.

Also of concern to one commenter was the perception that a migration from non-electronic to electronic engine controls was detrimental to vessel reliability. EPA believes that electronic controls are indeed reliable, as evidenced by the millions of miles accumulated by similar heavy-duty, on-highway trucks utilizing them. The commenter did not cite any study or data indicating that electronically-controlled engines are less-reliable than their predecessors. In fact, EPA believes that electronic engine controls can provide engine manufacturers and vessel operators with increased reliability (in that the diagnostic capabilities and engine control flexibilities inherent in electronic control systems can alert the operator of potential concerns).

While we acknowledge that uncontrolled soot regeneration can result in overheating of the filter, we point out that the probability of this occurrence is rare, and can be mitigated through proper calibration, control, and monitoring of the DPF. Again, it is the experience gained from use of DPFs in on-highway and nonroad applications that leads us to conclude that this technology is reliable today, and will only be more so in the future as millions of hours are accumulated on these devices prior to their implementation in the marine and rail sectors. If engine manufacturers and vessel builders determine that the uncontrolled regenerations and reactor burn-through are a risk – regardless of the application – system monitoring and engine control strategies can be employed to minimize the probability of such an occurrence and reduce the severity of a system failure, should one occur.

We do not expect that engine reliability and power for marine vessels will be compromised by the use of Tier 4 technologies. The commenter does not suggest how engine operating conditions and/or operating environments for marine diesel engines is more-severe than those founds in nonroad applications. Information to date from on-highway applications – both in the United States and, to a greater extent, in Europe – suggest that a properly designed and maintained DPF is a safe and reliable technology for reducing PM emissions. As engine manufacturers gain experience in challenging nonroad DPF applications, we expect this knowledge will result in reliable aftertreatment and engine control systems for the rail and marine industries that employ these technologies.

Concerning Caterpillar's comments, we believe that considering the available NOx to PM ratio of Tier 4 engines and the temperatures encountered, that there will be sufficient opportunity for passive regeneration that would prevent soot accumulation from occurring within the filter to an extent that would result in filter plugging. Given our experience with this technology and the transfer of technologies between sectors, we also believe that PM filters - when developed and implemented with consideration given to experience gained in other sectors - will be reliable, safe, and not cause unexpected exhaust restriction and loss of power. There is no suggestion that these filter technologies (and the experience gained from their application in other sectors) cannot be safely transferred to the marine sector. Engine manufacturers will have experience in the operational characteristics and reliability of these devices prior to their use in marine engines. The 400 °C temperature cited is for extruded vanadium wall-flow filters that are tolerant of fuel sulfur levels higher than that of ULSD. The 250 °C temperature was based on data cited within the RIA for operation using ULSD fuel and passive regeneration of trapped PM using NO_2 generated via oxidation of NO emission over platinum group metal (PGM) catalysts; either upstream of the DPF, coated to the DPF, or both upstream and coated. We do not expect the need for frequent active regeneration for these applications due to their NOx to PM ratio, the exhaust temperatures available during operation under load and the operation of the engines using ULSD. We do not expect carbon build-up to exceed DPF PM capacity due to the increased opportunity for passive regeneration for these applications.

10.4 Other

10.4.1 Aftertreatment Technology Demonstrations in Other Countries

What Commenters Said:

SCAQMD commented that it concurs with EPA's assessment that the proposed Tier 4 standard is technologically feasible. (The commenter cited the Draft RIA, p.4-32, "If no improvements were made to technologies which exists today, the 1.3 g/bhp-hr locomotive standard is technologically feasible.") The commenter noted that it has consulted with and visited several entities that have retrofitted or are ordering new locomotives (and marine vessels) with aftertreatment control devices. The commenter noted specifically Swiss Rail and Hug Engineering, one of the leading manufacturers of aftertreatment control devices. The commenter noted that Swiss Rail has gained enough experience with diesel particulate filters that it is ordering 73 new 2000 Hp diesel locomotives with fully integrated diesel particulate filters, and Swiss Rail plans to replace all of its existing diesel powered locomotives with new locomotives equipped with DPFs. The commenter further noted that Swiss Rail representatives also indicated that they have tested a smaller railyard locomotive with a combined DPF/SCR system. The commenter noted that Miratech, Hug Engineering's U.S. distributor, is currently conducting locomotive retrofit demonstrations for EPA and SCAQMD. The commenter stated that Hug's modular design approach could allow aftertreatment devices to be installed in a variety of configurations, which would help address space constraints. The commenter further noted that Hug has also integrated a DPF system into a planned 3500 hp line-haul locomotive, thus showing that such retrofits are possible. Additionally, SCAQMD noted that other manufacturers have begun work on designing aftertreatment devices into new and existing locomotives.

SCAQMD commented that it understands that there may be a fuel consumption penalty associated with the locomotive DPF, but noted (based on data regarding the use of DPFs in European locomotives) that the penalty will be no more than 1-2 percent provided the backpressure limitations are met. The commenter stated that it strongly believes that early field demonstrations of control technologies provide valuable opportunities for manufacturers to refine their products. (The commenter noted that it is also sponsoring two field demonstrations of SCR/diesel particulate filter technologies on passenger trains, applicable to both switch and line-haul locomotives.) The commenter noted that they - as well as CARB - are continuing discussions with locomotive manufacturers on demonstration projects that could result in locomotives with advanced aftertreatment controls in the 2010 to 2012 timeframe. Specifically, the commenter noted, the SCAQMD and CARB staffs recently discussed a potential project to demonstrate SCR technologies on Class I line-haul locomotives as a second phase to the passenger locomotive demonstration project.

AAR commented that at the public hearings, SCAQMD referred to locomotives in Europe equipped with DPFs, arguing the technology already exists for locomotives in the U.S. The commenter noted that Hug Engineering DPFs have been installed on 2000 hp horsepower switching locomotives operating in Switzerland, and one Hug DPF has been installed on a prototype 3600 horsepower locomotive, however CARB reports that there will be no locomotive models produced following the development of this prototype. The commenter stated that the U.S. should take advantage of lessons learned in Europe. However, as CARB observed, the fact that DPFs are being used on low-horsepower Swiss locomotives does not mean that the technology is ready to be installed on higher-horsepower line-haul locomotives in the U.S. The commenter specifically noted that only synthetic engine lube oil (low ash) can be used in the Swiss locomotives (the commenter stated that its understanding is that only the Swiss use synthetic oil in locomotive applications, which makes their locomotives unique in Europe and in the world). The commenter further noted that low sulfur diesel fuel (LSD) in Switzerland has a sulfur content around 300 ppm, but LSD in the U.S. is fuel with a sulfur content of up to 500 ppm. AAR lastly noted that Swiss railroads have no DPF maintenance responsibility until the manufacturer’s warranty expires; and in-service DPF exhaust emissions testing has not yet been performed (and is not planned).

EMD suggested that EPA should not rely too strongly on European experience to support the feasibility of the Tier 4 standards. The commenter acknowledged that there have been several applications of diesel particulate filtration and SCR in European locomotives. However, the commenter noted, European locomotive operation is very different from that in the United States. The commenter stated that North American locomotive operation is much more severe than that in Europe—for example, the bulk of locomotives fitted with diesel particulate filters in Europe are Swiss shunting locomotives (“switchers”, in American lexicon) and not subject to heavy operation even by European standards. EMD commented that there is one heavy haul locomotive in existence with a DPF, and it has seen only limited service and the manufacturer has no plans to build more. The commenter noted that in both this locomotive and the shunters, the engine takes up much less of the total space within the locomotive than in American locomotives, so packaging of aftertreatment components is relatively easier. The commenter urged that EPA recognize that projection of European results to the United States is an uncertain proposition at best; and it further stated that success in Europe does not lend much support to the feasibility of U.S. standards forcing aftertreatment.

MECA noted that it has received data from one of its member companies currently offering zeolite-based catalysts for sale in Europe for truck applications and developing zeolite-based catalysts for U.S. 2010 heavy-duty applications. The commenter stated that this data indicates that a zeolite-based catalyst maintains approximately 90% NOx conversion efficiency in a simulated diesel exhaust stream at exhaust temperatures ranging between 250 and 550 °C after hydrothermally aging the catalyst (in an air stream containing 10% water vapor and 20 ppm SO_2) for up to 2000 hours at 600 °C. The commenter stated that no degradation in NOx conversion efficiency in the 250-550 °C inlet exhaust temperature range was observed between fresh and aged catalysts. MECA also noted that its European affiliate association, Association of Emissions Control by Catalyst (AECC, www.aecc.be), recently completed a heavy-duty Euro VI demonstration program on a modern, low-NOx U.S. 2007-class diesel engine (7.5 liter engine displacement). In this program, an advanced diesel emission control system including a DOC + catalyst-based DPF (14 liter filter volume) and a urea-SCR zeolite-based catalyst (14 liter catalyst volume) + ammonia slip catalyst was evaluated for emissions performance following 200 hours of oven aging of the catalyst components at 600 °C. The commenter stated that over the European Steady-State Cycle (ESC), this aged system reduced NOx emissions by approximately 85% and PM mass emissions by more than 90%.

MECA further noted other studies and laboratory evaluations on zeolite-based SCR catalysts in its comments. The commenter stated that the performance of zeolite-based SCR catalysts is not expected to be impacted by operating in a locomotive or marine diesel exhaust that contains a 0.03 g/bhp-hr PM level (the proposed Tier 4 PM standard for these engines). The commenter referred to Fe-zeolite SCR catalysts which have recently been commercialized in Japan for heavy-duty truck applications. These applications combine a DOC placed in front of an SCR catalyst and operate with PM levels (at the SCR catalyst inlet) which are considerably higher than 0.03 g/bhp-hr with no reported problems.

Letters:
Association of American Railroads (AAR) OAR-2003-0190-0566.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502, 0594.1
Manufacturers of Emission Controls Association (MECA) OAR-2003-0190-572.1
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0483, 0558.1

Our Response:

While we acknowledge the concern of some commenters that aftertreatment technology demonstrations in Europe are not identical to the duty-cycle and/or operating conditions experienced in U.S. locomotive or marine operations, we do believe that these demonstrations serve to illustrate the emissions-reducing capability of DPF and SCR technologies. The Hug Engineering DPFs are a different technology than the DPF systems described in Chapter 4 of the RIA. The system is designed to operate at considerably higher fuel sulfur levels than the ULSD used for Tier 4, and thus the systems are designed to rely primarily on active soot regeneration using a fuel burner system. EPA staff met with representatives of Hug Engineering in May 2007 (see docket EPA-HQ-OAR-003-0190). Our understanding based on our meeting is that there are approximately 300 to 400 locomotives in Switzerland (operated by SBB, The Swiss Railway) equipped with 550 kW engines and Hug PM filters used for maintenance, construction and light switching operations. There are another 100 switch locomotives equipped with 1.5 MW Caterpillar 3512 engines and Hug PM filters. Some of these units have accumulated 15,000 hours of operation without needing ash maintenance. There is one additional short-haul locomotive equipped with a 2.7 MW engine and a Hug PM filter. Hug also has experience installing exhaust aftertreatment in marine applications up to 14.5 MW and stationary power applications up to 40 MW. Although the European experience with using PM filters on locomotives represents operation and equipment that differs from what is used in North America, it still represents an important base of knowledge that can be built upon as we progress towards implementation of the Tier 4 standards. There is much that can be learned from SBB and Hug with regards to in-use operational experience, catalyst packaging, substrate mounting and maintenance of the systems.

Our assessment of feasibility is based primarily upon an assessment of U.S. Tier 2 locomotives and U.S. locomotive operation, along with an assessment of catalytic PM and NOx control systems under development for the U.S., Europe and Japan for highway, nonroad, marine and locomotive applications (see Chapter 4 of the RIA for a discussion on the feasibility of the Tier 4 emission standards).

10.4.2 NOx Sensor Technology

What Commenters Said:

GE commented that NOx sensors currently available are not sufficiently accurate or reliable for locomotive applications. The commenter stated that data supplied by a NOx sensor manufacturer showed a degradation in performance over time that would drive NOx higher than acceptable limits. The commenter claimed that a significant technological invention – not just a breakthrough with existing technology – would be required to develop a NOx sensor capable of maintaining NOx levels within EPA guidelines over the useful life of the locomotive, with acceptable cost and with maintenance intervals that coincide with the needs of locomotive service.

GE also commented that NOx sensor sensitivity has a crucial role to play in the capability of a closed loop control system and estimated that even to achieve a 1.9 g/bhp-hr NOx level, current NOx sensors would require substantial improvement in sensitivity, selectivity, and resolution. The commenter stated that interference from ammonia on the NOx sensor can force the system to operate in a non-optimum manner, resulting in increased NOx or increased ammonia slip (or both). In addition, GE posed the following questions related to NOx sensor accuracy and the resultant conversion efficiency of the system:

- is a reliable NOx sensor, with 5% accuracy, available to control urea dosing sufficiently and achieve 95% NOx conversion when using a Zeolite-based SCR when not kinetically limited?
- is 5% of point the limit of point the limit of NOx sensor accuracy?
- does NOx sensor accuracy currently limit NOx conversion efficiency of feedback controlled SCR systems, and if so by how much?
- what level of NOx conversion efficiency using a Zeolite-based SCR when not kinetically limited is achievable using current feedback control systems using of zirconia-NOx sensors?
- what level of NOx conversion efficiency can be expected taking into consideration projected NOx sensor and feedback control system development over the next ten to fifteen years?"

GE further commented that the Siemens/VDO Smart NOx sensor is an advanced zirconia-based, multilayer, state-of-the art NOx sensor with 3 oxygen pumps, the accuracy of which is quoted at +/- 10%. GE stated that this sensor's accuracy limits NOx conversion efficiency for two reasons; 1) an error in NOx sensor reading in the feedback control system drives error in the dosing of the urea system, which either underdoses the system, resulting in poorer NOx conversion, or overdoses the system, resulting in greater ammonia slip, and 2) the inability of the zirconia NOx sensor to distinguish between NOx and ammonia (NH_3). The commenter stated that a system which has been overdosed with ammonia due to error in the NOx sensor reading will read the higher ammonia slip as additional NOx, and then may increase the ammonia dose, rather than decrease it, as is necessary for proper control – and that this propagation of error in the feedback control system makes the control system inherently unstable. Also, they stated that as the system goes out of control, the error compounds, rather than being limited to the single inaccuracy. The commenter also stated that the accuracy of NOx sensors is not expected to improve to be better than +/-5% (today's sensors have an accuracy of +/-10%, so reaching this entitlement by sensor manufacturers is a significant technical challenge). The commenter noted that closed loop control systems do enable system optimization around a point that minimizes a combined NOx/NH_3 output – and that absolute accuracy of the sensor is not required to find this minimum point – but without an absolute measurement, the minimum point does not assure compliance.

EMA commented that the durability of NOx sensors – a potential tool which can be used to detect urea quality – remains a key unresolved issue. The commenter stated that if a NOx sensor is used to determine urea quality, it is highly questionable whether an unanticipated NOx reading could be related solely to urea quality.

MECA noted that NOx sensors are commercially available and have been used on light-duty vehicle applications of lean-burn, gasoline direct injection engines to control NOx adsorber-based catalysts by some manufacturers. The commenter noted that NOx sensors are also under development by other manufacturers for applications on both highway and nonroad diesel engines to control catalyst-based NOx emission control systems and to provide diagnostic information concerning the performance of these systems. The commenter further stated that it expects suitable NOx sensors to be available for use on locomotives and marine diesel engines in time for Tier 4 applications.

NJDEP provided comments on EPA's request for feedback regarding NOx sensor accuracy requirements. NJDEP responded that the NGK/Siemens development target is 2% accuracy for new NOx sensors and 5% aged accuracy by 2014. NOx sensor control systems improve NH_3 metering systems by modulating feed proportional to engine-out NOx and consequently raising net mobile engine NOx performance incrementally above 95% by approaching 1:1 NH_3/NOx ratios and by lessening NH_3 bypass levels to below 5 ppm.

Letters:
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1
General Electric Transportation (GE) OAR-2003-0190-0590.1
Manufacturers of Emission Controls Association (MECA) OAR-2003-0190-572.1
New Jersey Department of Environmental Protection (NJDEP) OAR-2003-0190-0562.2

Our Response:

Several comments raised concerns about the durability and accuracy of NOx sensors, as relates to their use in control of urea- or reductant-based SCR systems. EPA has examined these concerns (also detailed in 4.3.5.1 of the Final RIA) and we believe that today's commercially-available NOx sensors are capable of meeting the accuracy and durability requirements necessary to achieve the Tier 4 locomotive and marine NOx standards. Concerning durability, EPA acknowledges that a NOx sensor's output may drift over time (at high mileage/hours), but control algorithms exist which compensate for sensor drift and assure control system accuracy as these components age. Several heavy-duty truck manufacturers have indicated that they will be applying today's NOx sensor technology to their 2010 products for control of urea dosing and aftertreatment system diagnostics. In addition, they state that they expect these sensors will be durable for the full useful life of the engine (will not be replaced as a scheduled service replacement part).

With respect to sensor accuracy, we believe that the Tier 4 standards are achievable with the current specification of +/- 10%. Since the primary function of the NOx sensor, when used for closed-loop control of urea dosing, is to provide feedback to the control system control as it strives to minimize the post-SCR NOx levels, the absolute accuracy of the sensor (in terms of the actual NOx ppm level present in the exhaust stream) is not significant. To ensure compliance with the NOx standard, EPA expects manufacturers will have a thorough understanding of their engine-out emissions in both the new and full useful life conditions. We do not anticipate that manufacturers will use NOx sensor output as a means of ensuring compliance with the standard.

10.4.3 Ammonia Slip

What Commenters Said:

EMD noted that, in both the locomotive and marine proposed regulations, EPA included language which is boilerplate in previous rules, preventing a locomotive or marine engine from emitting a noxious or toxic substance that it would otherwise not emit and that would contribute to an unreasonable risk to public health, welfare, and safety. The commenter stated that EPA should recognize that emissions of ammonia from NOx aftertreatment systems, "ammonia slip," will be inevitable in engines using SCR to meet the proposed Tier 4 standards, particularly during transients. The commenter noted that ammonia is a noxious gas toxic in high concentrations, detectable by the human olfactory system at concentrations between five and fifty parts per million. The commenter requested that EPA structure these paragraphs not to disallow emissions of ammonia at technically feasible levels; the commenter believes that if EPA fails to do so, manufacturers may be left with no way to meet the Tier 4 standards.

AAR commented that the railroads, along with locomotive manufacturers, also are concerned about the issue of ammonia slip. The commenter noted that the railroads cannot afford for there to be noxious ammonia fumes, as this would be an issue both for their employees and the communities in which they operate. The commenter stated that not only are ammonia fumes unpleasant, but the smelling of ammonia raises safety concerns that are not present elsewhere, such as in the trucking industry. The commenter noted that the railroads annually transport approximately 40,000 carloads of anhydrous ammonia, a toxic-by-inhalation hazardous material. AAR commented that if an employee or some other person smells ammonia from an SCR system in a rail yard, they might mistake the smell for anhydrous ammonia, resulting in evacuations, the disruption of rail services, and, perhaps, other adverse consequences.

GE commented that its calculations show that transient ammonia slip levels could reach around 50 ppm and steady-state levels are expected to be in excess of 10 ppm. The commenter stated that decreasing urea dosing levels to control the ammonia slip level will necessarily lead to increased NOx levels. The commenter further stated that even if an aftertreatment system can be built to perform with low ammonia slip under new, ideal conditions, that same system will inherently produce significant ammonia discharges as the system degrades and under transient engine operation as ammonia is stored and released on the catalyst. The commenter stated that it believes that the issue is maintaining low ammonia slip while still meeting a 1.3 g/bhp-hr NOx level. GE commented that it implemented a closed-loop control strategy into Monte Carlo models for catalyst system performance. The commenter stated that it is possible to ensure that ammonia slip levels stay within reasonable limits, but there is a tradeoff - an increase in NOx emissions. The commenter noted that, depending on the ammonia slip requirements, the dosing ratio of NH_3/NOx needs to be adjusted. GE commented that, at lower ammonia slip requirements, lower dosing ratios are required to meet these limits, which in turn results in lower SCR conversion and higher NOx emissions. The commenter requested that EPA acknowledge that ammonia slip emissions at steady state up to 25 ppm, and 100 ppm for transient operation, not be considered to violate the prohibition of proposed §1033.115(c). GE stated that EPA's rules mandate a design which leads to these slip levels, so it would be inappropriate (and arbitrary and capricious under CAA § 307(d)) to establish a rule that requires violation of one provision in order to satisfy another.

NJDEP provided comments on EPA's request for feedback on what level of ammonia slip is achievable from modern urea-SCR systems using closed-loop feedback control, and whether or not 5 ppm is an appropriate level to set for maximum ammonia slip under any conditions. The commenter stated that less than 10 ppm bypass with 95+% SCR NOx reduction is achieved under long term durability in mobile applications with older NOx sensor technology. 99% SCR NOx reduction has been achieved with 3 ppm NH_3 bypass. The commenter stated that both are achieved with key benefits provided by NOx sensor control of closed-loop NH_3 metering technology and thorough reductant mixing and uniform well dispersed flow through the SCR catalyst. NJDEP also commented that the 5 ppm NH_3 bypass limit is judged to be appropriate. The commenter stated that this will serve to sustain investment in continued NOx sensor technology development to control NH_3 bypass to below 5 ppm, which in turn places less reliance on NH_3 bypass catalytic oxidation clean-up (a selective technology also known for NOx reformation and N_2O emissions, a global warming gas).

NJDEP also provided comments regarding the feasibility of achieving low ammonia slip (bypass less than 5 ppm) from urea-based systems that dose at 1:1 NH_3/NOx ratio under extreme engine out 500-600 ppm NOx in steady state and transient load conditions. The commenter stated that low NH_3 by-pass at 1:1 NH_3/NOx feed ratio is feasible. The commenter noted that current mobile source systems achieve 95% NOx reduction with less than 10 ppm NH_3 bypass, and stationary engines achieve 99% NOx reduction with less than 3 ppm NH_3 bypass. The commenter stated that the combination of precise ammonia metering, two NOx sensors functioning in closed-loop feed-forward and feed-back control, and thorough mixing with uniform flow concentration through the SCR unit make less than 5 ppm NH_3 a feasible target.

Letters:
Association of American Railroads (AAR) OAR-2003-0190-0566.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
General Electric Transportation (GE) OAR-2003-0190-0590.1
New Jersey Department of Environmental Protection (NJDEP) OAR-2003-0190-0562.2

Our Response:

See also our responses in 10.4.2 (NOx Sensor Technology).

The issue of NH_3 emissions (or ammonia slip) was raised by several commenters, with claims that excessive NH_3 emissions are "inevitable", and may reach 50 ppm during steady-state operation. We have assessed this issue and concluded that a properly-designed slip catalyst, with good selectivity to nitrogen (N_2), can convert most of the excess NH_3 released from the SCR catalyst into N_2 and water. Recent studies by Johnson Matthey and the Association for Emissions Control by Catalyst (AECC) have shown that an aged SCR system equipped with a slip catalyst can achieve tailpipe NH_3 levels of less of than 10 ppm when tested on the European Stationary Cycle (ESC) and European Transient Cycle (ETC). EPA testing over a simulated locomotive duty cycle confirms very low NH_3 slip at very high NO_x conversion when using an appropriately designed slip catalyst with high selectivity (see Chapter 4 of our RIA). The SCR system in the Johnson Matthey study was aged on a cycle which included 400 hours of high-temperature operation at 650 °C (to simulate active DPF regeneration events). Our analysis of the locomotive engine operating conditions presumes a maximum, post-turbine exhaust temperature of 560 °C. This presumption is based on implementation of a "passive" DPF regeneration approach (in which NO_2 created by the oxidation catalyst is sufficient to oxidize trapped soot) and our own testing of locomotives during consist operation in non-ventilated tunnels. Under these conditions, we expect slip catalysts to be durable and effective in reducing NH_3 slip.

In Chapter 4 of the RIA, we also describe how ammonia slip can remain low at high NOx reduction efficiency even with relatively high NOx feedgas rates through the use of static mixers, closed-loop urea dosing and the use of a highly selective ammonia slip catalyst. Data published by Englehard (a catalyst manufacturer) and DAF (a European truck manufacturer) at the SAE 2006 World Congress (SAE 2006-01-0640) showed emissions results obtained using an ammonia slip catalyst configured into a hydrothermally-aged SCR catalyst system operated at high space velocities. The data showed that greater than 90% NOx removal could be achieved with less than 25 ppm of ammonia slip even at excessive dosing rates of greater than 1.3:1 and with NOx feedgas concentrations higher than those of Tier 2 locomotives. More moderate dosing rates near 1:1 resulted in peak ammonia slip of 6 ppm or less.[3] Recent engine tests conducted by EPA also showed similar results of very low ammonia slip and high conversion at high engine-out NOx concentrations comparable to those of a Tier 2 GE locomotive (see docket EPA-HQ-OAR-2003-0190).

Compact urea-SCR systems that have been developed to meet the U.S. 2010 heavy-duty truck standards use closed-loop controls that continuously monitor NO_x reduction performance. Such systems have the capability to control stack emissions of NH_3 to below 5 ppm during transient operation even without the use of an ammonia slip catalyst. We understand that such systems may still emit some very small level of uncontrolled pollutants and we would not generally consider a system that releases de minimis amounts of NH_3 or nitrous oxide (N_2O) while employing technology consistent with limiting these emissions to be in violation of §1033.115(c) – which is the same way we currently treat passenger cars and heavy-duty trucks with regard to N_2O and hydrogen sulfide (H_2S) emissions.

It also should be clear that the levels of slip which we believe could be experienced in the exhaust stack (<25 ppm) would be rapidly diluted by ambient air at a ratio well in excess of 1000:1, leading to ammonia levels near a Tier 4 locomotive or marine vessel which are well below levels detectable through smell (to an observer standing near, or operating, a locomotive or marine vessel). In addition, when locomotives are operating in railyards under low power or idle conditions, the exhaust temperatures are too low to support hydrolysis, and no urea dosing will occur. Similarly, for locomotive operation inside maintenance facilities, low power settings or battery power can be used to move the units without activating urea dosing system. Hence, we believe that AAR's concerns with regard to ammonia smells and false alarms at railyards are addressed with the systems we expect locomotive builders to apply.

10.4.4 Urea Infrastructure and On-Board Storage

What Commenters Said:

EMA commented that it is concerned that urea will not always be available for marine vessels when operating outside of the U.S. The commenter noted that when vessels return to the U.S. after extended operation in foreign waters, their urea supplies may have been depleted. The commenter noted that urea availability for locomotives and marine vessels will depend on significant infrastructure investment, and urged that the effective dates for the proposed Tier 4 standards need to take this into account. EMA stated that it believes adequate lead time is included in the NPRM to allow for infrastructure development, but it cannot be assumed that the infrastructure will be fully developed in all cases. The commenter further noted that a vessel cannot be limited in power when urea is not available, as engine power is needed for safe maneuvering and cannot be reduced. EMA commented that it believes that any reporting or recording procedures relating to urea use and quality should not be overly complex or burdensome.

EMA also commented that Tier 4 locomotives will require NOx control, which will likely include an SCR system and a ready supply of urea. The commenter stated that since urea is known to freeze at approximately -12°C (11°F), SCR systems that are exposed to extended low ambient temperatures will require some type of onboard heating elements or coolant flow systems to maintain sufficiently high urea temperatures during operation. EMA commented that it does not believe this will present a major technical challenge for most marine applications. The commenter noted that commercial marine engines generally operate in ambient conditions above urea-freeze temperatures, and likely will have internally mounted and protected urea tanks and injection systems which can be thermally managed. (The exception to this would be with respect to deck-mounted marine engines.) The commenter noted that locomotive engines can often operate in below urea-freeze temperatures—exposed tanks, lines, and pumps will be difficult to control thermally and special precautions, or even cold weather packages, may be required for certain line-haul and especially switcher locomotives. The commenter stated that, in the case of extended shutdown periods in frigid conditions, including days or weeks at a time, the only practical way to thaw the frozen urea will be through the use of heated engine coolant circulated around or through the urea tank. The commenter further stated that, as the main urea tank(s) are likely to be mounted externally, near the diesel fuel tanks, it will be especially challenging to thaw the tank after extended shutdown. An internal urea day tank may be mounted, which can be thawed electrically after engine(s) restart, but there will be some period of time in which urea flow will be inhibited and the SCR system will not be effective.

EMA further commented that main urea tanks on locomotives are expected to be between 7% and 10% of the on-board diesel fuel tanks, equating to a 350-500 gallon urea tank for a Tier 4 mainline locomotive, and a 100-200 gallon tank for a Tier 4 switcher locomotive. The commenter provided a table on the needed heat outputs for raising the temperature of these tanks from -20 °F to +15 °F (EPA-HQ-OAR-2003-0190-0575.1, p. 51). The commenter noted that, considering that an 85 amp alternator will be used for heating, and the heating elements operate at 90% efficiency, it can be anticipated that the urea tanks will take between 4 and 16 hours to thaw, not including the energy required to heat all lines and pumps to move urea to the point of injection. The commenter stated that a smaller internally-mounted day tank, which is expected to supply urea for the minimum 4 hours of operation, will have to be sized between 20 and 100 gallons, depending on whether the locomotive engages in switcher or mainline operation; the commenter stated that the most feasible way to thaw these smaller day tanks over the same 35 °F temperature rise is to use electrical elements, and provided a table with the necessary power requirements (OAR-2003-0190-0575.1, p. 52). The commenter noted that the time required to thaw the day tanks (assuming an 85 amp alternator and 90% efficiency elements) is expected to take up to 220 minutes, during which the SCR system will not be fully operational from either the main tank or the day tank, depending on day tank size. EMA stated that it thus believes that a 4-hour thaw period will need to be included in the final rule as an extended emissions compliance exclusion period for locomotives that experience extreme cold weather start-up conditions.

EMA commented that urea availability for locomotives and marine vessels will depend on significant infrastructure investment, and further stated that the effective dates for the proposed Tier 4 standards need to take this into account. The commenter stated that it believes adequate lead time is included in the NPRM to allow for infrastructure development, but it cannot be assumed that the infrastructure will be fully developed in all cases.

Caterpillar commented that an additional concern is how much urea must be carried on board. The commenter noted that, to cover the total fuel usage on board, urea storage requirements would be significantly greater than the amount that could be carried; and the commenter believes that this could seriously affect the practicality of urea SCR. The commenter requested that the on-board urea storage requirements be kept reasonable to keep urea SCR technology as a feasible approach; the commenter further stated that it believes that the requirements for urea storage should not exceed that required to cover the fuel that is carried with some modest margin. The commenter suggested that the urea storage capacity should be no more than 115% of that to cover the on-board fuel capacity.

Letters:
Caterpillar OAR-2003-0190-0594.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1, 0545

Our Response:

EMA raised the issue of reductant availability and infrastructure for both locomotives and marine vessels. As we explain in 4.3.1.1 of the RIA, we believe that there is adequate supply to satisfy the needs of the locomotive and marine sectors, and that there is adequate time to develop the supply/delivery infrastructure prior to implementation of the Tier 4 standards. We also believe that the centralized fueling nature of U.S.-based locomotive and marine operations will lend itself well to the migration and adaptation of urea supply solutions developed for the on-highway and nonroad sectors. For migratory vessels, which may operate in regions of the world where ULSD and/or reductant may not be available, a narrow exemption from the Tier 4 NOx standard is available (see section 3.2.5 of this Summary and Analysis of Comments document for a discussion of comments on vessels operating extensively outside the U.S.).

Concerning the commenters issue regarding urea freezing in Northern climates, as with our on-highway programs, we expect manufacturers will provide a method for thawing some portion of the frozen urea-water solution within a reasonable timeframe following a cold start. EPA's Urea Guidance Document for light-duty and heavy-duty vehicles states the following concerning urea freezing:

> "The reducing agent should not be adversely affected by extreme climatic conditions, particularly freezing temperatures. Some reducing agents freeze at temperatures that occur seasonally in certain parts of the U.S. Urea, for example, freezes at 11°F. Manufacturers need to either use a reducing agent that will not freeze at low temperatures, or design their SCR system to prevent freezing (e.g., use of heater elements in or around the storage tank and heated lines). Manufacturers who use a heated SCR system need to ensure that minimal "thaw" time is required to melt enough reducing agent to recharge the system, should the reducing agent freeze due to extensive exposure to low temperatures."

We believe many methods will develop for ensuring that the urea-water solution does not freeze during cold climate operation. These methods may range from insulated tanks/lines, electric- or coolant-heated tanks/lines, or a combination of both. Since line-haul locomotives do not use anti-freeze, any measures taken to prevent freezing of the engine coolant should allow similar opportunities to prevent urea freezing. We believe existing urea delivery and storage systems already provide thaw times of less than 4 hours. Advances in urea-SCR technologies will likely result in shorter thaw times, and we do not believe it is necessary to set a "minimum" thaw time at this point.

We are not specifying the reductant storage capacity for marine vessels or locomotives. It is expected that the manufacturers will provide enough onboard urea storage capacity to allow for uninterrupted NOx control, given the duty cycle, refueling, and usage patterns expected of each application.

10.4.5 Fuel Sulfur Level and Oil Formulation Effects

What Commenters Said:

EMA commented that an extremely important issue relating to the application of DPFs to marine applications is the fact that a large number of marine engines may operate on high sulfur fuel for substantial periods of time. The commenter raised the concern that, since the technology assumed by EPA is predicated on the use of ULSD, the operation on fuels other than ULSD will seriously impact regeneration efficiency and PM filter life. Additionally, the commenter stated that a serious concern with DPFs is the issue of trap plugging. The commenter noted that if regeneration does not occur on a regular basis, particulate filters can accumulate soot and create excessive backpressure, which can substantially reduce the power that the engine can generate. The commenter urged that an absolutely reliable regeneration capability must be available for filters that have the potential for plugging in marine applications. Lastly, the commenter stated that NOx aftertreatment technologies that do not use a separate reducing agent (non-additive) are not feasible for marine applications; the commenter stated that this is due to the fact that the demonstrated durability of the non-additive NOx aftertreatment approaches are not anywhere near what is needed for the marine environment.

Caterpillar and EMA commented that they believe EPA has underestimated the challenges for developing durable particulate aftertreatment systems. The commenters stated that EPA correctly states that phosphorous from the engine oil and sulfur from diesel fuel can deactivate a catalytic site, and cited EPA's statement (at 72 FR 15982) that "[t]he risk of catalyst deterioration due to sulfur poisoning will be all but eliminated with the 2012 implementation of ULSD fuel...." The commenters stated that this may be true for vessels always operating in the U.S. on ULSD, but is incorrect for U.S. vessels that will operate on high sulfur fuel when operating outside of the U.S. The commenters noted that many commercial vessels utilize ports outside the U.S., often for months at a time, and these ports will most likely have non-ULSD fuel which can deactivate catalysts. Caterpillar and EMA commented that the high fuel sulfur outside the U.S. will require the use of lubricating oil with higher (currently normal) ash to provide sufficient TBN to neutralize the sulfur making its way to the lubricating oil. The commenters stated that they are concerned that this higher ash will not be burned out of particulate filters and can increase the back pressure much more rapidly than would be seen with lubricants for ULSD; the ash accumulation will require more frequent cleaning of the particulate filters. EMA additionally commented that the extreme sensitivity to fuel sulfur makes non-additive NOx aftertreatment systems completely impractical due to the near certainty of exposure to fuel with significant sulfur levels in many marine applications.

EMA also commented that any final Tier 4 rule must ensure that adequate supplies of ULSD will be readily available at the U.S. ports that service and provide dockage to the commercial marine vessels and the very large recreational vessels that will be equipped with Tier 4 engines. Additionally, the commenter noted that the proposed Tier 4 PM standard will require the utilization of DPFs, which in turn require the consistent supply and utilization of ULSD to maintain emissions performance and to protect against potential overloading and clogging of the DPF system. The commenter further noted it is anticipated that the proposed Tier 4 NOx standard will require the utilization of SCR-based systems, which require the supply and use of aqueous urea as a reductant injected in the exhaust stream. The commenter requested that any vessel required to be equipped with Tier 4 engines and emission control systems must have ready and consistent access to adequate supplies of 15 ppm (or better) sulfur fuel and aqueous urea, and that the NPRM does not provide adequate assurance of this.

EMD commented that ULSD is an enabling technology for aftertreatment application and sulfur in diesel fuel has many deleterious effects on aftertreatment devices (such as: sulfate formation and catalyst poisoning in particulate traps, sulfate formation at high temperatures in oxidation catalysts, ammonium sulfate formation and catalyst fouling in selective catalytic reduction devices, and catalyst passivation in NOx adsorbers); therefore, a reliable supply of ULSD must be assured before aftertreatment can be introduced on the railroads, even for field test. The commenter noted that June 1, 2012 is the date for the refinery gate sulfur limit for locomotive and marine (LM) diesel fuel of 15 ppm. The commenter suggested that the start of the two-year field test of sulfur-sensitive aftertreatment must wait until the widespread availability of ULSD; otherwise, the test will fail due to misfueling with higher sulfur fuel and the objective of demonstrating system reliability will be lost. The commenter requested that, because of the need for a field test of at least two years and the need for time to evaluate the test results (including inspection of removed components), the earliest feasible date for introduction of aftertreatment on locomotives is January 1, 2015, as proposed in the NPRM. The commenter urged EPA to resist requests to accelerate aftertreatment application to earlier dates.

EMD further commented that the diesel fuel sulfur regulations (40 CFR Part 80, Subpart I) allow fuel with sulfur up to 500 ppm (such as transmix produced from fuel interfaces during pipeline shipment) to continue to be sold into the rail market indefinitely after June 1, 2012. The commenter stated that it believes that this poses a hazard for aftertreatment systems. The commenter stated that while the proposed locomotive rule requires units requiring ULSD to be so labeled near the fuel filler, such things are notoriously difficult to control on the railroads, and it will be difficult to ensure that aftertreatment-equipped locomotives receive only ULSD in service.

The New York State Department of Environmental Conservation commented that under current diesel fuel sulfur regulations, the ULSD necessary to support NOx and PM aftertreatment for locomotives will be available to railroads no later than fall 2012, and is available for research and development work today. The commenter further stated that the aftertreatment technologies expected to be employed, SCR and particulate traps, are well developed and currently in use in other applications. The commenter stated that it believes that aftertreatment based Tier 4 NOx and PM standards should be feasible with the availability of ULSD and should be implemented in 2013.

The Lake Carriers Association (LCA) commented that it believes that vessel operators must be assured that ULSD will be widely available in the U.S. marine market. The commenter further requested that the entity delivering the fuel to the vessel must provide assurance, perhaps through pump labeling, that the fuel being delivered is ULSD. The commenter also stated that a constant supply of urea is a necessity. The commenter stated that it believes that EPA should not mandate that engine performance be reduced (i.e., power derates) when urea is not available to the exhaust aftertreatment system.

EMD commented that, while it believes that it is too early to have full knowledge of the technology that will be required to meet the Tier 4 locomotive and marine engine emissions standards, it is concerned about the effects of oil ash deposition on catalyst durability; and the commenter stated that it believes EPA's view of the future of lubricating oil technology for these engines is overly optimistic and over simplified. The commenter cited EPA's statement that, "The high ash content in current locomotive and marine engine oil is related to the need for a high total base number (TBN) in the oil formulation. Because today's diesel fuel has relatively high sulfur levels, a high TBN in the engine oil is necessary today to neutralize the acids created when fuel-borne sulfur migrates to the crankcase. With the use of ULSD fuel, acid formation in the crankcase will not be a significant concern." The commenter stated that it believes that EPA's view is an over-simplification of a more complex issue. The commenter noted that technical requirements of engine oil require additional functionality in various areas which can increase the ash content of engine oil. EMD noted that EPA has indicated that locomotive and marine engine designs will have to reduce oil consumption to meet the Tier 3 and Tier 4 PM standards. The commenter raised the concern that the impact of those design changes will be to increase the stress on the engine oil, resulting in the need for an increase in detergency, metal deactivation, and dispersancy levels—which may increase the ash content of the oil and offset the effect of ULSD use. The commenter stated that it believes that without needed improvements in these areas, locomotive and marine engine owners will experience reduced oil life, with associated higher maintenance costs, and the potential for increased engine wear.

EMD commented that it is not necessarily true that the introduction of ULSD will make a simultaneous reduction on oil TBN requirements, especially because of the need to maintain alkaline reserve in the face of reduced oil consumption (which reduces the amount of fresh oil added to "sweeten the pot" or replenish the additive package) and the formation of organic acids (which also need to be neutralized if they enter the oil) during combustion. The commenter further stated that it believes that EPA's confidence in a future decline in rail and Category 2 marine engine oil TBN may be misplaced. The commenter raised the concern that only one oil formulation is used by the railroads, thus the various four-stroke (which tend to be harder on the oil because the blow-by gases go into the oil pan, rather than into the intake manifold as on a two-stroke) and two-stroke engines on a locomotive or marine vessel must utilize this same oil. The oil therefore must be designed for four-stroke operation; the commenter noted that the higher additization of oils developed for four-stroke operation, coupled with the higher oil consumption of two-strokes, means that more of the oil ash winds up in the exhaust on a two-stroke.

EMD also commented that the reference to on-highway low sulfated ash, phosphorous, and sulfur (low-SAPS) oil availability in October 2006 has no impact on the locomotive and marine diesel engine market. The commenter stated that highway engine oils are not designed to be used in current medium speed locomotive and marine diesel engines. The commenter noted that the additive chemistries are completely different and will require technological development by the additive and oil companies that serve the locomotive and marine markets as Tier 3 and Tier 4 engines are developed.

Letters:
Caterpillar OAR-2003-0190-0594.1
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0545, 0575.1
Lake Carriers' Association (LCA) OAR-2003-0190-0567.1
New York State Department of Environmental Conservation OAR-2003-0190-0583.1

Our Response:

Several commenters expressed their concern that ULSD – upon which the Tier 4 standards are based – will not be widely available when the standards take effect. The availability of ULSD is addressed in section 11.3.2 of this Summary and Analysis of Comments document. The fuel production and distribution industry is required to migrate to locomotive and marine (LM) ULSD in 2012, so the appropriate fuel should be available for Tier 4 engines. Even though low sulfur diesel fuel (LSD, fuel above 15 and at or below 500 ppm sulfur) may be available in the U.S. locomotive and marine market at that time, engines designed and certified by the manufacturer to operate only on ULSD must use this fuel at all times. Failure to do so will be considered tampering.

Also of concern with the availability of ULSD is the potential for clogging/plugging of the DPF (and the resultant increase in backpressure and loss of power) and de-activation of catalytic sites if higher sulfur fuel is used. Again, we believe that this issue only presents itself if the vessel is misfueled – where a "ULSD" label is either ignored or overlooked. For incidents of accidental misfueling, we do not believe that one tank of fuel with off-spec sulfur levels will permanently damage the exhaust aftertreatment devices. We expect that manufacturers, vessel owners, and fuel suppliers will implement the practices and methods used in the on-highway and nonroad sectors to deal with misfueling issues and ensure appropriate safeguards.

Oil formulation, and its importance to catalyst deterioration and engine life, were additional issues raised by several commenters. As the sulfur level in fuel is reduced, we expect that oil formulations will begin to change as well. In the 2007 heavy-duty highway truck market, with the introduction of DPFs and the switch-over to ULSD nationwide, the oil formulation was changed to a low-SAPS specification in order to accommodate the new operating conditions. While low-SAPS engine oil formulations may migrate to future locomotive and marine applications – which would be beneficial and directionally helpful in regards to the durability, performance, and maintenance of the exhaust aftertreatment components we reference – it is not a required element of our feasibility analysis. European truck and marine applications have shown that SCR is a durable technology, regardless of fuel sulfur level or oil ash content. One commenter suggested that these newer, low-SAPS oil formulations, developed for use in on-highway and nonroad diesel engines, may not be appropriate for locomotive or marine applications. While we acknowledge that the exact oil formulation for locomotive and marine applications using ULSD fuel is not known today, we do believe that there is adequate time to develop an appropriate oil formulation and DPF maintenance and ash cleaning intervals (if needed). For example, in the State of California, all intra-state locomotives, marine vessels (in the South Coast Air Quality Management District), and nonroad engines have been operating with ULSD since June 2006 – so there should already be field data/experience available today to begin understanding the effect that ULSD has on oil properties. In addition, the fuel production and distribution industry will be transitioning to 15 ppm nonroad (NR) nationwide in 2010, followed by 15 ppm LM in 2012 - again, leaving ample time to develop an oil formulation and additive package which meets the performance requirements of the locomotive and marine sectors. For marine vessels that spend much of their lives outside U.S. waters (in particular, places where ULSD is not available), there is a very narrow provision in the regulations to allow them to meet the Tier 3 emission standards instead of the aftertreatment-forcing Tier 4 emission standards (see Chapter 3 of this Summary and Analysis of Comments document for more detail on this subject).

10.4.6 Minimum Temperature for NOx Control

What Commenters Said:

EMA commented that, with respect to the technical feasibility of the Tier 4 NOx standards, EPA asserts that SCR NOx control strategies will "certainly be capable of precisely controlling NOx under all conditions whenever the exhaust temperature is greater than 150 °C." The commenter stated that this is inconsistent with the statement that urea hydrolyzes to CO and ammonia at higher temperatures (above 200 °C) (72 FR 15981). EMA commented that it believes that a minimum temperature of 250 °C must be included in the final rule, as this has been specified for nonroad and heavy-duty on-highway (HDOH) SCR systems. The commenter noted that exposure to higher sulfur fuels requires an even higher exhaust gas temperature for proper SCR operation. The commenter similarly stated that it believes that this minimum 250 °C temperature should also be used instead of the proposal to apply the NTE requirements for SCR-equipped engines when exhaust temperatures are at or above 150 °C (§1042.101(c)(2)(iv)(A)). EMA also commented that it believes that the NOx conversion efficiency under low temperature exhaust gas conditions can be improved by the use of an oxidation catalyst upstream of the SCR to promote the conversion of NO to NO_2. The commenter noted however that the few SCR systems currently in use on marine engines have generally not included an oxidation catalyst upstream, and thus such systems have not been adequately demonstrated in marine applications. (Additionally, the commenter noted that the SCR systems used in marine applications must be able to withstand prolonged periods of operation with fuel sulfur of greater than 0.5%.)

Letters:
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1, 0545

Our Response:

We have reviewed our existing regulatory programs for on-highway and nonroad engines and agree that the NTE temperature threshold should be consistent between these programs. Therefore we are finalizing provisions consistent with our on-highway and nonroad standards (250 °C – see 40 CFR 86.1370-2007). While we believe that improvements in urea dosing technology may enable urea hydrolysis at temperatures as low as 150 °C, the current practice for urea-SCR systems is to stop urea injection whenever exhaust temperatures drop below 250 °C in order to ensure adequate urea hydrolysis and appropriate system function. However, while manufacturers are not constrained by the limits of the NTE requirements below the 250°C threshold, they can not modulate urea dosing in a way that reduces NOx control unless such an auxiliary emission control device (AECD) function was necessary to prevent engine damage or to ensure safe operation (e.g., to limit ammonia slip).

10.4.7 Exposure to Environmental Contaminants/Abrasives

What Commenters Said:

NJDEP responded to EPA's request for comment concerning a manufacturer's claim that locomotive catalyst systems must withstand sand exposure at a rate of 50 pounds/hr and 500 pounds/hr of red china clay and silicon flour at notch 8 (full power/speed). EPA asked whether sand exposure is an appropriate metric (given locomotive air-intake filtration and the ability of turbocharger systems to withstand such exposure). EPA also asked if these conditions were used for testing turbocharger systems and emissions compliance following such rates of engine ingestion of abrasive material. NJDEP commented that it cannot be imagined that locomotives do not employ intake air filters (99.95% efficient) and associated coarse particle pre-filter technology to prevent large quantities of abrasive particles to be drawn into the engines when operating in dusty environments. The commenter stated that, in all the experience of DOC, DPF, SCR, and DPF + SCR, no deterioration of catalyst function due to engine sand or dust ingestion has been noted. Information on turbo-charger testing regarding such exposure can be obtained from turbocharger manufacturers. With regard to question 1 from the NPRM, NJDEP commented that SCR systems are thermally resistant to extreme temperatures of 700 °C and above. The commenter stated that SCR would not be exposed to excessive soot since the proven DPF removes 99+% of all solid particles (the commenter noted that partial filters remove a lower percentage of solid particles, and therefore are of concern). The commenter also stated that DPF and SCR mounting systems isolate the ceramic catalysts from vibration and shock (but noted that attention must be paid to ensure the system is properly designed). The commenter noted that internal water exposure is ever present in exhaust systems and this internal source has not been found to cause any physical or functional damage; however, it is necessary to protect the catalyst from direct rain inundation. NJDEP noted that one DPF + SCR supplier did caution that trapped water could damage substrates upon rapid heat up. The commenter also noted that decline in performance due to salt exposure has not been noticed in either marine or ocean environments; and further, sand and dusts will be removed in the inlet air filter (99.95%). The commenter stated that no effect due to sand or dusts on DPF, SCR, or DPF +SCR system physical properties or performance has been encountered thus far. NJDEP noted that that engine-out soot will be cleansed with a BAT DPF system and therefore soot will not affect SCR catalysts. The commenter also stated that so-called partial filters would not prevent SCR soot and metal-ash exposure. Further, the commenter recommended that only verified best available filter technology be permitted. The commenter also stated that there is a need for a thorough SCR NOx verification procedure (there has already been one started in Europe, with an open invitation to EPA to join).

With regard to the NPRM's request for comment regarding catalyst exposure to salt fogs, NJDEP commented that there have been over 300 SCR units installed in marine environments in the Netherlands and a fair number are installed on ferries and ocean-going ships. The commenter stated that there have been no reported function or performance issues related to salt exposure for SCR catalysts over many years with individual in-use of many units over 10,000 hours in actual use.

Regarding the request for comment with respect to whether or not any catalyst packaging and/or installation issues would necessitate any direct exposure of catalyst substrates to weather, NJDEP commented that DPFs and SCR units are large in size and do present packaging and location issues. The commenter noted that this will be minimized if the DPF + SCR functions can be combined into one catalyst unit; the commenter also noted that non-cylindrical configurations help minimize the issue. The commenter stated that exposure to weather of fully enclosed assemblies avoids direct exposure of catalyst substrates and therefore is not a problem. The commenter noted that one manufacturer did express concern for water inundation of the SCR unit; to this end, the commenter stated that location in the space occupied by the acoustic muffler (only BAT DPF technology has muffling capability) is the ideal space but will require cooperative engineering work of engine makers and DPF + SCR system suppliers.

In its comments, GE provided detailed usage data to the question posed in the NPRM regarding how attributes of the locomotive operating environment could impact the ability of a Zeolite SCR-type catalyst to operate within 10% of its 'as new' conversion efficiency (~94%) after 34,000 MW-hours of operation:

- Water exposure due to rains, icing, water spray and condensed frozen or liquid water during 20% of its life.
- Salt fog consisting of 5+/-1% salt concentration by weight with fallout rate between 0.00625 and 0.0375 ml/cm2/hr.
- The catalysts will be subject to sands composed of 95% of SiO_2 with particle size between 1 to 650 microns in diameter with sand concentration of 1.1 +/-0.25 g/m3 and air velocity of 29 m/s (104 km/h).
- Exposure to dusts comprised of red china clay and silicon flour of particle sizes that are between 1 to 650 microns in diameter with dust concentration of 10.6 +/-7 g/m3 with a velocity equal to locomotive motion velocity on catalyst surfaces.

Caterpillar and EMA commented that engines operating on the ocean ingest salt from the general salt water spray, which will accumulate in the particulate filters and will not be oxidized. The commenters noted that the extent of this accumulation has not been assessed, but they noted that the impact may be the requirement of more frequent cleaning of non-combustible material or much shorter filter life requiring complete replacement of the filter. Caterpillar commented that filter plugging may occur so rapidly as to make their applications completely impractical. EMA further commented that it is also unknown exactly how salt spray ingestion might affect the SCR catalyst; poisoning and degradation of the catalyst are a real possibility.

EMA also noted that locomotive engines often operate in very dusty environments; the air filters remove most of the dust, but a small percentage gets through and this dust will not be removed during regeneration. The commenter noted that this will add to the ash build-up from the fuel and oil. The commenter further stated that the net effect of this will be more required maintenance for cleaning, and, if the cleaning methods do not completely restore the backpressure, a requirement to completely replace the particulate filters. EMA noted that nonroad Tier 4 applications beginning in 2011 have yet to be demonstrated in similar dusty applications.

MECA commented that locomotives and marine diesel engines will include air filtering elements designed to protect the engine and these same air filter elements will provide protection to the catalysts equipped on these engines from large particulates that might be present in the inlet combustion air to the engine. MECA also stated that it understands that some of the concerns raised for exposure to salt fog, sand, china clay, and silicon flour are military specifications for external surfaces of vehicles and are not pertinent to catalysts contained within the exhaust stream of a locomotive.

<u>Letters:</u>
Caterpillar OAR-2003-0190-0485, 0594.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0545, 0575.1
General Electric Transportation (GE)OAR-2003-0190-0590.1
Manufacturers of Emission Controls Association (MECA) OAR-2003-0190-572.1
New Jersey Department of Environmental Protection (NJDEP) OAR-2003-0190-0562.2

Our Response:

Several commenters raised concerns about the effect that environmental factors such as exposure to dust, abrasives, rain, and salt fogs will have on the performance and durability of aftertreatment components. In particular, EMA stated that for a wall-flow DPF, any dust which passes through the engine could be captured in the DPF, where it would become part of the incombustible “ash” mass. For locomotives in this environment – as it would be for marine, nonroad, or on-highway engines in a similar environment – the frequency of the ash cleaning maintenance would increase unless measures are taken to reduce the amount of dust and contaminants entering the engine. We believe that this scenario (where contaminants pass through the engine and are trapped by the DPF) is best dealt with by filtering air before it enters the engine. The commenter does not state a level of contaminant ingestion that today's engines experience when operated in the conditions described (nor what affect such levels would have on engine durability, let alone durability of the aftertreatment components.) We believe that solutions already exist in the construction vehicle sector to deal with air filtration in dusty environments.

Several commenters also raised concerns about exposure of catalyst components to rain, ice, and salt fogs. We expect that locomotive manufacturers and vessel builders will install the appropriate shields, baffles, and/or water drainage paths to protect the catalyst components from direct exposure to these environmental hazards. For salt fog exposure, articulated flaps, caps, or doors can be employed to close the exhaust stack when the engine is not running.

10.4.8 Vibration and Shock Loads

What Commenters Said:

AAR commented that an important operating factor is vibration, exacerbated by the location of aftertreatment devices above the engine. The commenter stated that whether catalysts can maintain their efficiency at such high temperatures and extended periods of significant vibration is at best unknown.

NJDEP provided comments in response to EPA's request for comments on various issues. The commenter noted that EPA requested more specific information regarding shock and vibration, soot exposure, and temperature exposure for existing zeolite-based SCR or under development; NJDEP hired Dr. John Mooney to address these topics. Regarding shock and vibration, NJDEP noted that mounting technologies for ceramic catalysts are well developed, broadly applied, and already proven for locomotive applications. The commenter noted that shock and vibration effects, if noticed in applications, are corrected utilizing established catalyst mounting technology. The commenter further stated that it is noted that RFQ specifications to technology suppliers for new Tier 4 engines will most certainly include reasonable and appropriate engineering-based shock and vibration test and limits for DPF + SCR systems.

GE noted that the NPRM indicated that thermal and mechanical vibration durability of catalysts is an issue and that the NPRM stated that it has been addressed through the selection of proper materials and the design of support and mounting structures capable of withstanding the shock and vibration levels present in locomotive and marine applications. However, the commenter stated that it does not believe that this statement is supported in the record. The commenter stated that the expected shock loading of the catalyst is estimated at 10G-12G, based on a 2G force shock loading at the coupling (with a typical locomotive experiencing 1000 such pulses each year) being transmitted to the catalyst. The catalyst is also subject to periods of vibration, where the load can reach 6G at a frequency of 1000 Hertz (Hz). GE also commented that, to its knowledge, no source of information supports the proposition that the catalyst can withstand this shock. The commenter further stated that, given the fact that trucks do not have to withstand this shock loading, EPA must at least evaluate the ability of the catalyst to withstand the shock loading before promulgating the standard and must respond substantively to these concerns. GE commented that if the catalyst cannot withstand these loadings, EPA should adjust the standard (or require catalyst manufacturers to warrant based on the shock loadings expected).

MECA commented that Zeolite-based SCR catalysts are expected to withstand the mechanical and ambient conditions required for locomotive applications. The commenter noted that SCR systems have already been designed, or are being designed, to deal with mechanical and thermo-mechanical conditions associated with passenger cars, trucks, and marine vessels. The commenter stated that it believes that these mechanical and ambient conditions are expected to be no more severe for locomotive applications. The commenter also noted that durability under thermo-mechanical environments depends on both the physical strength of the catalyst element and the design of the packaging system that contains the catalyst element(s). MECA commented that its members have considerable experience in packaging catalysts for severe thermo-mechanical environments. The commenter noted that system design engineers can utilize a variety of tools, including hot vibration testing and engine testing, to design and validate effective system designs that can withstand the thermo-mechanical environment present in the exhaust.

Letters:
Association of American Railroads (AAR) OAR-2003-0190-0566.1
General Electric Transportation (GE) OAR-2003-0190-0590.1
Manufacturers of Emission Controls Association (MECA) OAR-2003-0190-572.1
New Jersey Department of Environmental Protection (NJDEP) OAR-2003-0190-0562.2

Our Response:

GE's estimation of a "10G-12G level of shock loading" is consistent with EPA's understanding of what catalyst substrate manufacturers, catalyst canners, and exhaust system manufacturers are currently designing for components subject to the durability requirements for on-highway, marine, and nonroad Tier 4 applications. In nonroad applications such as logging equipment, the exhaust system components can be subject to shock loads as high as 20 G, and catalysts tested in these applications have not had significant problems with durability when subjected to shock loads at this level. Furthermore, we reference the ABS specification for exhaust manifolds on diesel engines, which states that loads can be as high as +/-10 G at 600 °C. Based on the experience that manufacturers have with catalysts on existing equipment and vehicles, we do not believe that vibration and shock loading will prevent their use on locomotive and marine applications.

10.4.9 Aftertreatment Maintenance/Replacement Intervals

What Commenters Said:

GE commented that analysis of recent data shows that elements of the catalyst system (i.e., the DOC) will need to be replaced at intervals somewhere between 4 months and 2 years, at a cost to the railroads on the order of $60,000 per replacement. The commenter stated that each such replacement will require the locomotive to be removed from service and moved to a facility equipped with the appropriate cranes and other equipment to replace the catalyst. The commenter raised the concern that neither the cost nor the extreme disruptions of removing locomotives from service were taken into account in the proposal; the commenter stated that EPA appears to assume that the catalyst will not need to be replaced at any intervals. GE also commented that there are 2006 and 2007 studies that have been conducted using ULSD and low sulfur oil on real (rather than simulated) diesel exhaust using zeolite catalysts. The commenter noted that these studies show that use of ULSD as a fuel and low sulfur oil is not sufficient to prevent poisoning of the catalyst, thus reducing the conversion efficiency; the commenter stated that it has analyzed the data presented in these papers to determine the replacement intervals required to assure compliance with a 1.3 g/bhp-hr NOx standard over the useful life of the locomotive.

Letters:
General Electric Transportation (GE)OAR-2003-0190-0590.1

Our Response:

Regarding the commenter's concern about catalyst system durability and their expectation of a short service interval, we refer to Chapter 4 of the Final RIA, where a detailed analysis of catalyst durability is presented. In particular, Figures 30 and 31 offer evidence that catalyst performance does not deteriorate appreciably under the conditions present in locomotive operation (which are similar to those in marine operations) – even when exposed to accelerated oil and ash poisoning and high hours simulating the full useful life of the engine.

10.4.10Requests for Technology Reviews and Feasibility Analysis

What Commenters Said:

In its comments, GE provided suggested regulatory language modeled on prior EPA rules regarding a catalyst technology review and petition process. The commenter stated that, unlike the review EPA conducted in 1999 for the 1997 heavy-duty truck standards, the language that it provided is narrowly crafted to minimize the burden on EPA and provide certainty as stakeholders invest in achieving the Tier 4 standards. GE noted, for example, that it is not requesting a wholesale technology review or for EPA to revisit the space constraint issues; it instead seeks only a targeted catalyst deterioration evaluation that can be conducted after further research and development have been conducted. The commenter stated that it believes that 2010 is the appropriate time for the formal review to occur because it allows for progress in catalyst technology while still being consistent with a development timeframe. The commenter suggested that the review be performed no later than December 31, 2010, and that EPA revise the standard if the catalyst deterioration is greater than EPA has estimated in establishing the Tier 4 standard. The commenter also requested that EPA state in the final rule what deterioration rate is being assumed for the catalyst in arriving at the final Tier 4 NOx standard. The commenter suggested that EPA could model the language on the provision it used for the heavy duty engine technology review, as promulgated in 1997.

GE also commented that EPA should recognize that over the next 10 years, additional technology advancements may occur that would reduce emission levels, and the rules should allow manufacturers to take these technologies into account in determining the certified emission level. The commenter also noted that there could be many viable NOx-reducing technologies, and the commenter believes that the final rule should not restrict the methods by which manufacturers might meet the Tier 4 NOx (or any other) standard. The commenter further urged that EPA ensure that the regulatory language does not act as a barrier to implementation of such technologies that achieve emission reductions, particularly where they can rely on pollution prevention rather than add-on controls.

EMD commented that there is time for development work on the technology that EPA proposes to apply to locomotives in the 2015 to 2017 timeframe and to marine vessels starting in 2014. EMD commented that, under these circumstances, it is willing to proceed without challenging the standards that would force the introduction of such technology to locomotives and marine engines. However, the commenter requested that EPA include provisions in the final rule for periodic technical reviews of progress toward meeting the standards, and whether the standards continue to be appropriate under paragraph 213(a)(5) of the Clean Air Act. The commenter suggested that these reviews should begin no later than the year 2010, as a 2015 application of componentry representing such a major departure from current locomotive and marine engine practice will require a multiple-unit field test beginning at least by 2012, and design work should get under way at least by 2010. EMD suggested that the reviews should continue at least annually thereafter. The commenter further suggested that, because of the competitive situation between major locomotive and engine manufacturers, EPA should conduct the reviews with each manufacturer separately. Lastly, EMD commented that it believes that the worst possibility that could come out of this rulemaking would be to shut down major suppliers to the rail and marine transportation industries because the last bit of emissions reduction proved unattainable.

EMA noted that the preamble (72 FR 15980) identified four main issues relating to aftertreatment systems; 1) the efficacy of the fundamental catalyst technology in terms of the percent reduction in emissions given certain engine conditions such as exhaust temperature, 2) applicability in terms of packaging, 3) long-term durability, and 4) whether or not the technology significantly affects an industry’s supply chain infrastructure - especially to supplying urea reductant for SCR to locomotives and vessels. EMA commented that it believes there are many more issues that must be addressed in assessing the application of DPF aftertreatment systems to marine applications. The commenter stated that the other significant questions that must be resolved by EPA in finalizing the rule include the following:

1) Can passive regeneration be relied on to ensure oxidation of trapped soot under all operating conditions? (The commenter noted that most observers believe that the answer to this is "no," and this is especially true for engines where the engine-out NOx level is controlled to a low level.)
2) Can potential increases in NO_2 emissions be minimized and maintained at acceptable levels?
3) Can effective active regenerating schemes be developed to ensure that trapped soot can be oxidized effectively under all engine operating conditions?
4) Will active regenerating systems be reliable and dependable over the full useful life of the engine?
5) Can increases in emission constituents (primarily HC) be avoided during regeneration events?
6) Can safety issues associated with extremely hot exhaust gas and exhaust system components during regeneration events be successfully addressed?
7) Can maintenance burdens associated with filter ash removal be reduced to an acceptable level?
8) Can DPF systems be designed and packaged such that they can be accommodated within the applicable space constraints without exceeding exhaust back-pressure limits?
9) Can CDPFs be made functionally and physically compatible with the NOx aftertreatment systems that will also be required?
10) Can the costs of these systems (including acquisition costs, maintenance costs and operating costs) be reduced to an acceptable level?
11) Will CDPFs be accepted in the marine marketplace?

<u>Letters:</u>
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0545, 0575.1
General Electric Transportation (GE) OAR-2003-0190-0590.1

Our Response:

Several commenters asked that EPA commit to a future technology review (or series of reviews) to assess the progress of Tier 4 technology development for the locomotive and marine sectors (as has been done in the past for other EPA mobile source programs involving advanced technology), and, if appropriate, to revise the program standards or implementation schedule accordingly. Many of the questions posed by EMA have been addressed in Chapter 4 of the RIA and in this Summary & Analysis of Comments as follows:

EMA Question #	Summary & Analysis of Comments Reference
1,2	10.2.6, 10.2.7, 10.3.7
3	10.2.4
4	10.2.4 and 10.4.3
5	(*see below*)
6	10.3.7
7	10.2.7 and 10.2.8
8	10.2.8
9	10.2.1
10	10.1.2.3, 10.2.1 (and S&A chapter 5)
11	10.3.7

Concerning EMA question #5, the increases in HC emissions can be minimized through careful system design and calibration. In addition, we expect that regeneration events will be infrequent, and as such, any increase in emission constituents can be factored into the emissions certification test result.

As with all of our technology-forcing standards, we believe that the smooth implementation of this program calls for EPA's continued involvement in assessing and encouraging technology development. Should significant new information come forward that prompts a reconsideration of these standards we would, as a matter of course, pursue this. As discussed in detail in Chapter 4 of the Final RIA, we agree that much engineering work remains to be done to migrate advanced aftertreatment technologies into the locomotive and large marine diesel sectors. We believe, however, that the engineering and development path in the several years before the Tier 4 phase-in is clearly laid out, and that a commitment to a formal review is not warranted, and indeed could prove disruptive. We note that interest in a future technology review on a predetermined schedule was by no means universal among those in the affected industries who commented, recognizing that this creates some element of uncertainty for the long-term program.

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11 OTHER

What We Proposed:

The items raised in the following comments were not all specifically proposed in the Notice of Proposed Rulemaking (NPRM), therefore many of these comments do not have a corresponding NPRM section. For those that do, we have provided (in our responses) information on where the item can be located in the proposal. For the full text of comments summarized here, please refer to the public docket for this rulemaking (EPA-HQ-OAR-2003-0190).

11.1 Comments Outside Scope of the Proposal

11.1.1 Nonroad On-Board Diagnostics (OBD)

What Commenters Said:

The Engine Manufacturers Association (EMA) noted that it recently provided comments to EPA on the heavy-duty on-highway (HDOH) on-board diagnostics (OBD) proposal regarding the key considerations for implementing a nonroad OBD program at some point in the future (docket ID number OAR-2005-0047; also included in OAR-2003-0190-0575, pp. 63-65). The commenter noted that while the comments were specifically focused on the broader range of nonroad engines, the considerations are generally the same for marine and locomotive engines as well.

<u>Letters:</u>
Engine Manufacturers Association (EMA) OAR-2003-0190-0575.1

Our Response:

We did not propose, and are not finalizing, general OBD requirements in this rulemaking process. We have added these comments to the docket for the ongoing HD OBD rulemaking where they can be more appropriately addressed.

11.1.2 Greenhouse Gases/Fuel Economy

What Commenters Said:

Friends of the Earth commented that it would like EPA to consider the addition of regulations for greenhouse gas (GHG) emissions from harbor craft. The commenter noted that several states including Washington and California have recently published maritime and GHG inventories; the commenter urged EPA to review the existing research and conduct analysis of the fuel use and GHG emissions from ferries and other harbor craft to better understand their contributions to global climate change and other effects. The commenter particularly stated that it would be beneficial to see a per passenger mile comparison between commuter ferries and landside commute modes for carbon dioxide and passengers carried per gallon of fuel, and suggested that EPA may also want to consider fuel economy standards for passenger ferries.

Electro-Motive Diesel, Inc (EMD) commented that, though a recent Supreme Court decision has found that EPA does have the power to regulate GHG emissions, it urged EPA not to regulate GHGs explicitly in this rulemaking. The commenter noted that, as EPA recognizes, the emissions of carbon dioxide (CO_2) – a greenhouse gas – are directly proportional to petroleum fuel consumption. The commenter further stated that marine transportation is the most fuel efficient method of moving freight, with the difficulty that barge tows do not climb mountains very well. EMD commented that rail transportation is the second most fuel efficient method of moving freight, with an approximate three-to-one overall advantage over truck transportation, and thus produce the lowest levels of CO_2 emissions per net ton-mile.

EMD commented that one of EPA's major goals in this rulemaking is the reduction of oxides of nitrogen (NOx) emissions from rail and marine engines. The commenter noted the inverse relationship between NOx emissions and fuel consumption (reduction of NOx emissions places upward pressure on fuel consumption and GHG emissions). The commenter stated that, even if manufacturers are able to minimize fuel consumption increases through intelligent application of technology, a fuel consumption opportunity cost still exists; had the requirement to reduce NOx emissions not been in place, the same or similar technology could have been used to improve fuel consumption. EPA should not impose any requirements that would complicate manufacturers'' already difficult task of managing the fuel consumption/NOx relationship, lest it jeopardize EPA's major NOx emissions goal. EMD also recommended that EPA should not put in place, in service of GHG reduction, any measures that would increase the cost of rail or marine operation (such as the use of biodiesel fuel). The commenter stated that, despite the one dollar per gallon tax preference for biodiesel in the Energy Policy Act of 2005, it believes that biodiesel remains more expensive to the user than petroleum diesel. The commenter further stated that an increase in fuel cost to rail and marine transportation will have the effect of shifting freight to less fuel-efficient modes, likely increasing overall GHG emissions.

EMD also commented that selective catalytic reduction (SCR) for NOx emission reduction – which is being used for demonstration of the feasibility of the Tier 4 NOx standards –causes CO_2 emissions. (The commenter noted that the urea hydrolysis reaction yields one mole of CO_2 for every two moles of ammonia (NH_3) released; because of the approximately 1:1 NH_3: NOx molar ratio required for optimal SCR operation, each mole of NOx reduced emits one-half mole of CO_2.) The commenter requested that EPA not put in place any regulation that effectively prevents the use of SCR, which the commenter stated is currently the only aftertreatment technology that shows any promise of being durable in locomotive and marine service.

AAR commented that GHG emissions are not addressed by the Notice of Proposed Rulemaking (NPRM), but noted that the proposed standards surely will affect GHG emissions. The commenter noted that carbon emissions are the major GHG byproduct of locomotives, and carbon emissions are directly related to fuel consumption. The commenter noted that the railroads' record with respect to fuel efficiency is outstanding: railroads are 80 percent more fuel efficient than they were in 1980; 27 percent more efficient than they were in 1990; and since 1998, the year the last locomotive emissions standards were issued, the railroads are 10 percent more efficient, even though some of the emissions reduction measures caused a loss of fuel efficiency. The commenter further noted that in 2006 alone, U.S. freight railroads consumed 3.3 billion gallons of fuel less than they would have if their fuel efficiency had remained constant since 1980 (i.e., they emitted 37 million fewer tons of CO_2); and, from 1980 through 2006, they consumed 45 billion fewer gallons of fuel and emitted 500 million fewer tons of CO_2 than they would have if fuel efficiency had not improved. The commenter stated that railroads now move a ton of freight 423 miles on one gallon of diesel fue1. (*Footnote 5: Statistics on fuel consumption and revenue ton-miles per gallon of fuel consumed are published by AAR in Railroad Facts: 2006 Edition, p. 40. The data in this publication are through 2005. AAR has preliminary data for 2006 and has used that data in these calculations. AAR used the Energy Information Administration's calculation of22.384 pounds of carbon dioxide per gallon of diesel fuel to calculate tons of carbon dioxide released and saved. See* *http://www.eia.doe.gov/oiaf/1605/coefficients.html. Note that at the May 10 hearing, the American Waterways Operators badly underestimated the efficiency of railroad transportation.*)

AAR commented that it believes that EPA significantly understated the projected adverse fuel impacts from the proposed standards. The commenter further noted that, as a result of those adverse fuel impacts, GHG emissions will increase. AAR commented that, while the locomotive and marine rule does not specifically concern GHG emissions, EPA was directed by President Bush to take steps to reduce the emissions of GHGs. The commenter stated that it believes that EPA does not yet have a clear strategy on balancing the sometimes conflicting objectives of reducing GHGs, NOx, and PM—the commenter stated that it would not make sense for EPA to adopt locomotive emissions regulations that will result in a significant increase in GHG emissions while elsewhere the agency is developing a strategy to reduce GHG emissions. AAR commented that it is particularly concerned that EPA did not adopt regulations requiring NOx reductions that can only be accomplished by increasing fuel consumption and increasing the emissions of GHGs. The commenter noted that several groups called for further NOx reductions prior to Tier 4 at the May hearings, without explaining how those reductions could be accomplished. The commenter stated that it believes that implicit in such requests is that EPA ignore GHG emissions and fuel consumption, which would not be in the public interest from both an environmental perspective or from the perspective of the country's efforts to attain energy independence.

Crowley Maritime Corporation (Crowley) commented that that marine transportation is the most energy efficient transportation mode for moving cargo. The commenter noted that, in terms of emissions of sulfur oxides (SOx) and particulate matter (PM) per ton of cargo moved, it is comparable to other modes and its greenhouse gas emissions are significantly less than other modes.

The Port of Seattle commented that it believes that the rule should be expanded to include GHG emissions limits. The commenter stated that there is an urgent need to effectively protect the earth's climate and success in doing so will depend on GHG emission reductions across the inventory, including emissions from locomotives and marine engines. The commenter further stated that it believes if GHG emission limits are added, the option of using credits for at least a fraction of the required reduction should be considered since climate is a global issue and emission reductions should be achieved in the most effective manner.

GE commented that the emission standards should take into account all pollutants, recognizing that reducing one pollutant may lead to increases in another (especially for the Tier 4 standards); the commenter stated that, in particular, EPA should consider the effects of the proposed standards on "emissions" of GHGs under Clean Air Act Section 213(a)(5). Moreover, the commenter stated, EPA is required to consider the energy impacts – particularly where such impacts would increase GHGs. GE commented that it believes that improving fuel efficiency should also be a priority. The commenter stated that, in light of the Supreme Court decision from Massachusetts v. EPA, it is critical for EPA to take steps that will ensure that the rule is neutral in terms of fuel and also allows for improved fuel efficiency and GHG emissions reductions – leading to a standard that balances reductions in NOx and particulate with reductions in CO_2.

GE commented that, although the proposed revisions to the Tier 0, 1, and 2 NOx limits may well be achievable, some of these revisions may have other negative effects such as increased GHG emissions. The commenter stated that the standards should be technologically achievable in the time frame allowed, but noted that the proposal did not take into account the significant fuel efficiency penalty associated with bringing these units to a Tier 1 level standard. GE commented that the new Tier 0 standard will both impact other pollutants and have a negative energy impact.

GE noted that there is concern about deterioration of the SCR performance over the useful life of the engine. As the system ages, the only way to reduce emissions would be through fuel injection timing retard to offset deterioration in the NOx catalyst performance.

GE also commented that it agrees with EPA that the rule should encourage innovations that can help to meet the standards at lower costs with less fuel and less CO_2. The commenter further noted that a benefit of ensuring credit for technology innovations is that it focuses on environmental performance; manufacturers can reduce emissions through pollution prevention, which could, for example, reduce the load on aftertreatment devices. The commenter noted that for NOx, this could reduce the amount of urea that a locomotive would need to carry for its SCR system, thus improving fuel economy and reducing GHG emissions. GE also suggested that EPA could also include an option for manufacturers to add other methods of reducing emissions to their certificates, such as hybrids, which will also offer carbon reduction and reductions in fuel consumption compared to today's locomotives. Lastly, the commenter suggested that EPA included provision for manufacturers to take throttle/speed management systems into account when determining the certified emissions level, as these systems could (in principle) be applied to any engine and achieve fuels savings and reductions in CO_2 (and NOx and PM) emissions.

MTU Detroit Diesel, Inc. (MTU) commented that the relatively short proposed phase-in of the Tier 3 standards (from 2012 until 2016) for other marine engines requires that interim emission reduction technologies and components be developed specifically for those other engines. The commenter stated that it believes that these provisions are not in the best interest of some manufacturers in terms of limited engineering resources and dollars, since an intermediate step from Tier 2 to Tier 3 is not necessary to reach the ultimate 1.8 g/kW-hr Tier 4 NOx limit. The commenter stated that, to reach the proposed 5.4 g/kW-hr Tier 3 NOx limit with internal engine measures would result in engines with higher fuel consumption, and thus higher fuel costs and increased CO_2 emissions. The commenter suggested that a direct step from the Tier 2 to the Tier 4 NOx levels is technologically feasible for some engines (3.5-7.0 L/cyl), and could help to avoid the drawbacks of the "interim" Tier 3 standards for these marine engines. The commenter stated that Tier 2 engines would produce less CO_2 emissions due to the greater fuel efficiency, which would then be transferred to Tier 4 engines.

PVA commented that the NPRM seeks to reduce two classes of unfavorable emissions at a cost of increased fuel consumption, increased CO_2 generation, new or expanded fuel/urea distribution and production systems. The commenter stated that it believes that these (and other) factors may reduce the positive effects of this rulemaking through the detrimental impact on other environmental programs such as the reduction of GHGs.

Tidewater commented that the rule's proposed emissions reductions will partly be achieved by engine manufacturers tuning their engines to produce lower emissions at the expense of peak engine efficiency, thus increasing fuel consumption as much as 5% or more. The commenter asked if EPA has performed a cost-benefit analysis on this impact of the regulations.

Caterpillar commented that it believes that the requirement to use ultra-low sulfur diesel fuel (ULSD) will increase CO_2 emissions due to higher energy consumption at refineries to produce the ULSD for applications currently using heavy fuel.

Letters:

Association of American Railroads (AAR) OAR-2003-0190-0566.1
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485
Crowley Maritime Corporation OAR-2003-0190-0641
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502
Friends of the Earth OAR-2003-0190-0609
General Electric Transportation (GE) OAR-2003-0190-0590.1
MTU Detroit Diesel, Inc. (MTU) OAR-2003-0190-0573.1

New Jersey Department of Environmental Protection, Air Quality Management (NJDEP) OAR-2003-0190-0562.2
Passenger Vessel Association (PVA) OAR-2003-0190-0507
Port of Seattle OAR-2003-0190-0469.1
Tidewater Inc. OAR-2003-0190-0557

Our Response:

EPA agrees with the commenters who note that we should examine the possibility of directly addressing GHG emissions in the locomotive and marine diesel sector, as well as other sectors, as appropriate; however, we do not believe it is appropriate to do so in the context of this rulemaking. All gasoline and diesel powered engines produce GHG emissions. In 2003, passenger cars and light duty trucks produced 35 percent and 27 percent of total U.S. transportation-related GHG emissions, respectively. By comparison, in 2003, marine engines produced about 3 percent of U.S. transportation-related GHG emissions while rail produced 2 percent of total transportation-related GHG emissions.[1] The U.S. EPA is currently considering whether greenhouse gas emissions from on-highway vehicles and engines cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare.

While we agree that GHG emissions from locomotives and marine diesel engines are an issue worthy of review, EPA would need to delay any final action on this rule for several years if we decided to review the possibility of regulating GHG emissions, much less actually promulgating GHG regulations in this rulemaking. We would first need to determine whether it is appropriate to regulate GHG emissions from these engines. If so, we would then need to engage in research and development regarding the numerous issues related to GHG regulation prior to taking final action on such a regulation. None of that work has been done to date. In contrast, this rule has been the subject of several years of research and deliberation, and was proposed in March 2007 prior to the decision of the Supreme Court in Massachusetts v. EPA. It should be noted that the locomotive and marine diesel engines subject to this final rule were not the subject of the section 202 petition that occasioned the recent Supreme Court decision. Rather this rule has always been focused on completing an important step in EPA's ongoing National Clean Diesel Campaign (NCDC) by adding new programs that reduce locomotive and marine diesel engine emissions of PM and NOx to the clean diesel initiatives that EPA has already undertaken for highway, other nonroad, and stationary diesel engines. Absent this rulemaking, PM and NOx emission levels for locomotive and marine diesel engines would remain at much higher levels--comparable to the emissions for highway trucks in the early 1990s.

Given the substantial and pressing need for both the PM and NOx emission reductions that will be achieved as a result of this rule, we believe it would be counterproductive to delay final action on this rule in order to review the possibility of regulating GHG emissions. This rule significantly strengthens the locomotive and marine diesel emission standards for NOx and PM

1 U.S. EPA, (2006) Greenhouse Gas Emissions from the U.S. Transportation Sector 1990-2003. Office of Transportation and Air Quality. EPA 420 R 06 003.

we proposed in March of 2007, especially in controlling emissions during the critical early years through the introduction of advanced technologies and the more complete coverage of existing locomotive and marine diesel engines. When fully implemented, this coordinated set of new programs will reduce harmful diesel engine emissions to a small fraction of their previous levels. Absent this final action, by 2030 the relative contributions of NO_x and $PM_{2.5}$ from locomotive and marine diesel engines to the national transportation emissions inventory will grow to 35 and 65 percent, respectively.

Some industry commenters stated that the technology used to meet the standards in this rulemaking will increase fuel consumption and thereby GHG emissions from locomotives and marine diesel engines. We acknowledge that the locomotive and marine remanufacture and Tier 4 emissions standards being finalized will impact fuel economy, resulting in small fuel consumption and CO_2 increases of less than 1 percent overall. For individual Tier 4 locomotives and marine diesel engines the projected increase is about 1 percent. Our analysis (see section 5.4 of the Final RIA) does not agree with the unsubstantiated commenter claims of much larger fuel impacts, or of any fuel economy impact from the Tier 3 marine standards. In fact, technology improvements have historically eliminated these marginal fuel impacts projected for our mobile source programs, and it is our expectation that similar continuing technology improvement will eliminate the modest fuel and CO_2 impact estimated here. However, because we cannot project the time frame when these improvements would be realized, we have included these impacts in our cost estimates for the full period of the program to avoid underestimating costs. As noted in our analysis, required under Executive Order 13211: Actions That Significantly Affect Energy Supply, Distribution, or Use, we project this rule will result in an energy effect that exceeds the 4,000 barrel per day threshold noted in this executive order around the year 2022 and thereafter. Further, our cost, emissions inventory and economic impact analyses have all included this estimate of increased fuel consumption.

As previously indicated, the percentage increase in GHG emissions resulting from this rule will be small, compared to the reductions in PM and NOx. The particular costs associated with increases in GHG emissions are a matter that is under review currently, and we have not calculated such costs in this rule. Nonetheless, even if we had calculated the cost associated with increased GHG emissions, based on estimates used by other entities, this rule would still provide significant net benefits.

Furthermore we believe that the comprehensive program we are finalizing, including the performance-based standards with averaging, banking, and trading provisions, make it likely that our estimated energy, cost, and GHG impacts are all overstated because they do not reflect the potential fuel savings associated with these provisions. EPA agrees with commenters who have urged EPA to finalize innovative requirements which will encourage less fuel consumption from locomotives compared to today's locomotives. Innovative provisions we are finalizing include: requirements for automatic engine stop/start (AESS) systems, incentives to adopt other idle reduction technologies, the new cleaner switcher locomotive standards based on nonroad engines (which reduce fuel consumption by almost 20 percent compared to the locomotives they replace), and emissions credit for efficient consist management practices. Taken together these technologies and practices can provide significant fuel savings to industry while also reducing GHG emissions.

Regarding the comment about fuel economy impacts from in-use injection timing retardation to offset SCR catalyst degradation, we have factored conservative projections of catalyst deterioration into our determination of appropriate full useful-life standards. These projections are based on experience with existing catalyst technologies and reasonable expectations for key operating parameters such as real-world high exhaust temperature excursions. We do not agree that additional engine-out NOx reductions will be needed to compensate for even greater deterioration rates than our conservative projections.

Finally, regarding the comment that the requirement to use ULSD would increase GHG emissions due to high energy consumption at refineries to produce the ULSD for application currently using heavy fuel (residual) we recognize that distillate fuel will be needed in marine auxiliary engines currently using residual fuel; however, the number of residual fuel auxiliary engines in the U.S. fleet is much smaller than the number of engines that use distillate fuel. There are approximately 300 vessels above 10,000 deadweight tons (about 2 percent of the world fleet) flagged in the United States, and a small number of other vessels that use residual fuel. The incremental increase in distillate diesel demand from those applications switching from residual fuel to distillate in the future would be small in comparison to the total amount of distillate diesel fuel currently used in highway, nonroad, marine, and locomotive applications and the growth expected in fuel consumed in those engines. The additional consumption of distillate is not expected to require shifts that would significantly affect the market, or to noticeably higher GHG emissions from refineries producing that small increment of fuel. In any case, the ULSD requirements for both locomotive and marine diesel engines were promulgated in the 2004 Nonroad Tier 4 rulemaking and not as part of this current rulemaking. The costs and energy impacts associated with production of ULSD for the nonroad sector, including locomotives and marine diesel engines, have been accounted for in this earlier rulemaking.

11.1.3 World-wide Harmonization

What Commenters Said:

The Commission Centrale Pour La Navigation Du Rhin (CCNR) provided comments to update EPA on current developments in future emission regulations in Europe, and differences in the discussions on both sides of the Atlantic; to inform EPA when making final decisions on future emission regulations for inland navigation engines. The commenter noted that within the Expert Group on Exhaust Emissions from Inland Navigation Engines (now led by the Joint Research Centre of the European Commission) the representatives of the engine manufacturers presented proposals for future emission limits—proposals which were very similar to EPA's proposed standards, as the manufactures strive for full alignment with EPA regulations. The commenter noted however that representatives from the CCNR member states and some of the CCNR observer states, while also supporting world-wide harmonization, do not fully agree with these proposals. Particularly suggested were: more ambitious limit values for carbon monoxide (CO), as current experience suggests that they are feasible and are currently appropriate in order to better protect the people who work and live on inland barges; separation of limit values for hydrocarbon (HC) and NOx, as they have very different health and environmental effects and as MIX emissions should be as low as possible; and keeping the number of engine categories as low as possible and in the regulations as simple as possible, in line with current attempts in Europe and the CCNR for better and 'lighter' regulation.

CCNR provided the experts' proposals for stage IIIB and stage IV (and information on the reasoning behind them) within its comments. The commenter stated that with the aim of simplifying the future regulations and supporting possible alignment with the proposal of the EPA emission limits for NOx using a continuous function, as currently applied by the CCNR and IMO, are no longer put forward. The commenter suggested that in 2012, the proposal for stage IV should be assessed in light of the actual developments of exhaust abatement systems; and for smaller engines, these developments (profiting from on highway applications) seem to be promising already today. The commenter noted that the German Federal Ministry for the Environment, the lead government agency in this case, does not judge the proposal of the engine manufacturers sufficient; the Federal Ministry suggested instead skipping stage IIIB and the respective technology development altogether, aiming for stage IV in 2012 instead. The commenter stated however, that there is hope that with the tightening of emission limits Germany will be able to support the induction of stage IIIB as an intermediate step towards stage IV.

CCNR commented that it would highly appreciate EPA considering CCNR's described proposals and concerns in finalizing the rule. The commenter noted that its member states would view such action by EPA as support for global harmonization of emission regulations and in line with EPA's strong commitment for the protection of the environment and the health of the people living on and near the water.

AABENRAA MOTORFABRIK recommended that the U.S. ratify MARPOL VI, and that EPA's regulations do not overrule MARPOL. The commenter stated that it strongly recommends that the U.S. ensure that the regulations in force in the U.S. are the same as in any other country of the world.

Markle Marine Safety Services noted that MARPOL Annex VI standards for engines are not very rigorous and only set standards for NOx and fuel sulfur content. Markle commented that, now that Annex VI is in force, it believes EPA should work with the U.S. Coast Guard at the IMO Marine Environment Protection Committee to revise Annex VI to include appropriate PM, HC, and revised NOx standards. The commenter also suggested that an attempt be made to revise the fuel sulfur content standard as well, so that ULSD will be available worldwide. Lastly, Markle commented that it believes that international shipping pollution standards should be addressed globally, and not attempted with unilateral national action.

<u>Letters:</u>

AABENRAA MOTORFABRIK OAR-2003-0190-0549
Commission Centrale Pour La Navigation Du Rhin OAR-2003-0190-0715
Markle Marine Safety Services OAR-2003-0190-0547.1

Our Response:

We appreciate the comments of the CCNR and the efforts that the various parties have made to help EPA consider the development of emissions regulations in other countries in setting the regulations we are finalizing today. We share a common goal with these parties to set where appropriate harmonized emissions test procedures and standards. We have given consideration to the potential to introduce the Tier 4 emissions standards as early as 2012 as recommended by the CCNR but have concluded that we can not at this time project with appropriate confidence that the technologies necessary can be developed and introduced by that time. We agree that in evaluating such an approach, one should consider skipping Tier 3 (stage IIIB in the CCNR comments) in order to more quickly achieve the Tier 4 standards. We have evaluated such an approach as Alternative 4 in section VII (Alternative Program Options) of the preamble to the final rule. Our analysis there shows that skipping the interim emissions standards would lead to increased emissions when compared to the program we have finalized. We intend to continue to work with all parties to seek harmonized emissions standards where appropriate.

We recognize the value of harmonizing emission standards, to the extent possible, with other nations, and we will continue to engage the international community. At the same time, we have an obligation under the Clean Air Act to set standards for new nonroad engines (including new marine diesel engines) that reflect the greatest degree of emission control achievable. These controls are necessary to protect human health and welfare and to reduce the impact of marine diesel engine emissions on air quality in the United States. As discussed elsewhere in this Summary and Analysis of Comments and in the preamble for this rule, these engines contribute significantly to air quality problems in coastal and port areas, and it is important to develop long-term standards that will help mitigate these efforts. We believe that C1 and C2 marine engines can substantially reduce emissions beyond Tier 2 levels and that the benefits associated with these standards far outweigh the costs.

With respect to the comments regarding MARPOL Annex VI, we note that the U.S. is currently working toward ratification of IMO Annex VI for C3 marine engines. Further, EPA is currently working through the IMO Marine Environment Protection Committee (MEPC) to revise Annex VI international standards for C3 marine engines with respect to NOx, PM, and fuel sulfur content. These standards would also apply to C1 and C2 engines onboard ships with C3 main propulsion engines.

MARPOL does not overrule EPA's legal requirement under the Clean Air Act to put out standards reflecting the "greatest degree of emission achievable." The current MARPOL NOx standards are expected to extend to all vessels used in the marine environment; however, a special provision has been included in paragraph 1(b)(ii) (of "regulation 13" of Annex VI of

MARPOL 73/78) to allow Member States to set different standards for engines installed on ships used domestically. In this action, we are setting more stringent national requirements which fulfill EPA's obligation under the Clean Air Act.

11.1.4 Comments on Other Environmental Concerns

What Commenters Said:

The Environmental Club of Colorado State University-Pueblo commented that it is glad to see that new regulations are going to be implemented restricting air pollutants from lawn mowers and small boat engines, however the commenter believes that the dates which these regulations will go into effect are too far out. The commenter believes that it is possible to lessen the regulatory lead time, and requested that EPA consider enacting the regulations sooner, "as the Earth desperately needs clean air as do we all."

A private citizen commented that he believes EPA needs to gradually force all taxis in the U.S. to be hybrid gas/electric. The commenter noted that taxis in major cities spend a lot of time burning gasoline while stopped in traffic or at traffic lights; and that, with electric power, no power or pollution is expended while stopped at traffic lights. The commenter also requested that EPA eliminate incandescent lighting and require fluorescent lighting, as Europe is currently doing. Lastly, the commenter stated that conservation of energy will result in less pollution.

A private citizen commented that it is time to address all areas of pollution.

A private citizen commented that he hopes these regulations will extend to all transportation vehicles and continue on into the private sector as well. The citizen noted that, at one time, he did not place interest in public transportation but now feels (with new climate science) that public transportation should be more widely available, and thus that emissions needs to be addressed.

<u>Letters:</u>
Environmental Club of Colorado State University-Pueblo OAR-2003-0190-0466
Private CitizenOAR-2003-0190-0470
Private CitizenOAR-2003-0190-0532
Private CitizenOAR-2003-0190-0544

Our Response:

We appreciate all of the commenters concerns, however this rulemaking is solely focused on regulating the emissions from locomotive and marine diesel engines and vessels; thus, these comments are outside the scope of this rulemaking. We believe that the comment regarding emissions from lawnmowers and small boat engines was intended to be a comment on the proposed rule for nonroad spark-ignited engines, vessels, and equipment ("Control of Emissions from Nonroad Spark-Ignition Engines and Equipment", May 18, 2007), and we have placed this comment in the docket for that rulemaking (OAR-2004-0008); additional information on the rulemaking, as well as the regulatory documents, can be found at: www.epa.gov/otaq/equip-ld.htm#regs.

11.2 Comment Period

What Commenters Said:

Kirby Corporation requested that EPA approach the development of regulations in a measured, deliberate manner in which the regulatory community has an adequate opportunity to comment on proposed regulatory text. The commenter stated that it is imperative that entities affected under the rulemaking are given a forum for public comment on proposed regulations once they are in draft form. Kirby also requested that EPA allow adequate time to implement the regulations to accommodate education of the affected regulated community and ensure availability of materials to comply with the regulations.

National Maintenance & Repair, Inc. commented that the current proposed regulations were written without any input from the aftermarket suppliers. The commenter stated that it believes that EPA was remiss in not determining the extent of the aftermarket involvement in the rail and marine industries; and further, the commenter believes that EPA should extend the comment period to allow such entities time to prepare and present their comments.

Similarly Caterpillar, Inc. commented that it remains concerned that EPA has not engaged the full range of affected entities for the marine portion of the NPRM to the extent necessary for broad industry engagement. The commenter stated that, while the proposed Tier 3 emission standards have some nominal effect on vessel design and operation, the addition of Tier 4 aftertreatment standards will require significant vessel redesign and new methods of vessel operation and maintenance. The commenter noted that parties such as vessel architects, owners, operators, fuel suppliers, aftertreatment suppliers, and non-EPA regulators (such as the U.S. Coast Guard and the American Bureau of Shipping (ABS)), have a direct stake in the successful outcome of these standards. Caterpillar commented that it will participate in delivering certified configurations for the regulated markets it chooses to supply to, but believes that these and other affected entities must be consulted directly by EPA to be sure their input is considered. Caterpillar noted that, via the EMA and in personal conversations, it has worked with a few of these affected parties but believes that EPA has the broadest and most effective outreach mechanism available to complete this critical task. Caterpillar urged EPA to reach out to these parties prior to releasing final regulations that have the potential to significantly impact the operation and commercial viability of many marine businesses and supporting industries.

EMD commented that EPA has made an unusually large number of requests for comment on areas of substance in the NPRM. The commenter further stated that it believes the NPRM reads more like an Advance Notice of Proposed Rulemaking than like the preamble of a rule that is to be made final in a few months. The commenter noted that the original locomotive emissions rule, 40 CFR Part 92, took nearly five years from the time of the first industry meetings in 1992 to the NPRM in 1997, while this rule – in many ways more complicated than Part 92 – has taken only just over three years from the first industry meetings in October of 2003 until the NPRM. EMD commented that it believes this tight schedule has left many issues unsettled that would have been resolved in a rulemaking spread over a longer time period. The commenter noted that this situation causes great concern for engine and locomotive manufacturers, as EPA will receive comment in many areas in which the thinking is not yet well crystallized. The commenter further stated that this could create, from the NPRM and from comments, a final rule that EPA, manufacturers, railroads, and marine vessel operators will have to live with and abide by for years to come (as the EPA Administrator has directed staff to finalize the rule by the end of the year 2007). EMD commented that industry's concern is that EPA will finalize provisions that are not well discussed and that will be unworkable in day-to-day operations. EMD thus urged EPA to solicit input from stakeholders in all aspects of the final rule so that a rule that meets EPA's objectives, while not being unduly onerous to manufacturers and users of locomotives and marine engines, can be developed. The commenter also suggested that EPA work closely with stakeholders in incorporating the information received as a result of the numerous requests for comment in the NPRM.

Letters:
Caterpillar Inc. (Caterpillar) OAR-2003-0190-0485
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0502
Kirby Corporation OAR-2003-0190-0563.1
National Maintenance & Repair, Inc. OAR-2003-0190-0655

Our Response:

We appreciate that commenters wanted as much time as possible to adequately review the proposal and be able to provide comments. We provided for a 90-day comment period for this proposal, as we believed that this would provide ample time for stakeholders to provide comments and for EPA to analyze those comments and finish the final rule in a timely manner. All of these commenters, and many others, provided robust, detailed, pointed, and helpful comments on the proposed rule. Further, EPA does not believe any commenter was prejudiced by the 90-day period for submitting public comment. We also note that while the rule was not published in the Federal Register until April 3, 2007, pre-publication versions of the proposed regulations and preamble were posted on EPA's website on March 1, 2007 (the day of the proposed rule's signing), providing commenters with more than 90 days to prepare comments on critical aspects of the proposed rule.

EPA has made every effort to reach out to potentially affected industries and stakeholders regarding the locomotive and marine regulations. Further, to ensure that we are able to reach a wide audience, we have worked with many industry organizations (such as EMA, AWO, and AAR) to help inform those in their respective industries that may not have been aware of the rulemaking initially. During the development of the final rule, we worked collaboratively with regulated entities and other stakeholders to resolve questions and issues raised in the NPRM. We will continue to work with these parties (and others) following the publication of the final rule and throughout the locomotive and marine program implementation.

11.3 Other

11.3.1 ASTM Standards Referenced in NPRM

What Commenters Said:

ASTM International provided comments regarding standards referenced in the NRPM that have been updated and/or deleted. (The specific updates can be found in ASTM's comments at OAR-2003-0190-0464 and OAR-2003-0190-0465.)

Letters:
ASTM International OAR-2003-0190-0464, 0465

Our Response:

We appreciate the commenter's clarification on the referenced standards. We have made a comprehensive review of the various ASTM standards we reference in the regulations and made the necessary changes to ensure that we are relying on the most recently adopted standards.

11.3.2 Sulfur Limits and Diesel Pump Labeling

What Commenters Said:

Cummins, Inc commented that for marine vessels with Tier 4 engines, vessel operators must be assured that the fuel being delivered to the vessel is ULSD, however the commenter does not believe that the current labeling requirements are sufficient to meet this need. The commenter noted that the fuel specification at the pump must be ULSD, and the pump must be labeled accordingly; the commenter further stated that it believes that, absent a pump labeling requirement in the regulation, there will be no incentive for fuel suppliers to label pumps as ULSD. Cummins suggested that the responsibility needs to reside with the final supplying entity to deliver ULSD, not with the vessel operator to find a ULSD fuel supplier.

EMD noted that, per the final Nonroad Diesel Rule, the sulfur content of fuel produced for locomotives and marine engines is required to be reduced to 15 ppm maximum beginning June 1, 2012. The commenter stated that, at this fuel sulfur content, NOx reduction technologies such as NOx adsorbers are not durable due to passivation of the catalysts by sulfur, thus rendering SCR to be the only viable means of meeting the aftertreatment-forcing Tier 4 NOx emissions standards for locomotives and marine engines. EMD noted that manufacturers in other industries have urged lowering of fuel sulfur content to 10 parts per million (ppm) maximum, believing that at that level NOx adsorbers would be a viable technology. The commenter stated that, while such a reduction might cause a marginal increase in fuel cost, the benefits would be great if it enabled the use of NOx adsorbers. The commenter further noted that: railroads and marine operators would not have to handle a reductant in addition to diesel fuel, separate tankage for such a reductant on board locomotives or marine vessels would not have to be provided, EPA's concern that engines might be operated without a reductant would be put to rest, and the requirements for diagnostics to monitor reductant level and quality would disappear. EMD urged EPA to evaluate a further reduction to in-use fuel sulfur content to allow more options for NOx aftertreatment technology. Similarly, Markle Marine Safety Services (0547.1) also suggested that EPA consider revising the fuel sulfur content standard so that ULSD will be available worldwide.

EMA also commented that it believes that EPA must ensure that an adequate supply of ULSD is readily available at the U.S. ports that service and provide dockage to the marine vessels that will be equipped with Tier 4 engines. The commenter noted that Tier 4 engine systems cannot operate on 500 ppm sulfur fuel without emissions compliance issues and undue risks of damage or fouling, and requested that EPA ensure in the final rule that the marine diesel fuel that reaches U.S. ports as of 2014 will have a sulfur limit capped at 15 ppm. EMA thus recommended that EPA reduce the downstream sulfur limit for marine diesel fuel to 15 ppm to match the refinery gate standard, just as it did for the diesel fuel used in on-highway and nonroad applications. The commenter also requested that EPA require downstream providers and retailers of marine diesel fuel to label which fuel supplies are compliant with the 15 ppm sulfur cap.

<u>Letters:</u>
Cummins Inc. OAR-2003-0190-0501
Electro-Motive Diesel, Inc. (EMD) OAR-2003-0190-0594.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0545, 0575.1
Markle Marine Safety Services OAR-2003-0190-0547.1

Our Response:

The comments on labeling center around the concern that EPA did not set a strict downstream requirement on the use of 15 ppm locomotive and marine (LM) diesel fuel (while refiners are required to begin producing 15 ppm LM diesel fuel on June 1, 2012, we allow the downstream use of both 15 ppm LM and 500 ppm LM) and the commenter is concerned that this could lead to unavailability of 15 ppm LM diesel fuel at the pump. The commenters fear, for example, that while a port might receive deliveries of 15 ppm LM fuel, the port might keep its pump labeled as "500 ppm LM" to allow it to receive and dispense either 15 ppm or 500 ppm LM diesel fuel. (As part of the diesel fuel regulations, all pumps dispensing diesel fuel must be labeled with the type and maximum sulfur level of the diesel fuel being dispensed.) The commenters were concerned that if such practice were widespread, Tier 4 marine vessels that require ULSD could potentially have problems finding it.

As discussed further in section IV.A.(9) of the preamble to the final rule, we understand the commenters' concerns, and have discussed a few potential solutions to this problem. One possible option is to require large ports (i.e., ports over some certain size) to make 15 ppm LM diesel fuel available. This size requirement could be by volume of single sale, or above some other specified volume. Under this requirement, those ports with multiple tanks could continue to offer 500 ppm LM diesel fuel in addition to the 15 ppm LM diesel fuel. Or, if a port (regardless of size) continues to sell 500 ppm LM diesel fuel, it must also sell 15 ppm LM diesel fuel. Another potential option would be to limit the sale of 500 ppm LM diesel fuel to small ports and locomotives only. However, these potential solutions would need to be discussed thoroughly with all stakeholders (including those in the fuel distribution and marketing industry) and put out for notice and comment. Therefore, we merely note potential solutions in the preamble to the final rule, but we are committing to investigate this issue further and, if the facts warrant doing so, addressing it in a separate action.

We are finalizing engine labeling requirements in the final rule to ensure that vessel and equipment operators are aware of the fueling requirements for Tier 4 engines; these labeling requirements are located in the regulations at 40 CFR 1033.135 and 1042.135 for locomotive and marine diesel engines, respectively.

We appreciate the comments regarding the further reduction of the fuel sulfur level for LM diesel fuel, however we are not finalizing any additional fuel sulfur requirements in this rulemaking.

11.3.3 Certification Testing on Residual Fuel

What Commenters Said:

EMA commented that the proposed standards, like the current standards, would apply to all newly built marine diesel engines regardless of the fuel they are designed to use, including residual fuel. Thus, the commenter stated, if a Category 1 (C1) or Category 2 (C2) engine is designed to be capable of using residual fuel as well as distillate fuel, emission testing must be performed using a commercially available fuel of that type (§1042.101(d)(3), 72 FR 16005). The commenter stated that it believes that this requirement poses very significant problems for residual-fueled marine engines. The commenter noted that the PM measurement methodology for fuel oil with sulfur content below 0.8% (8000 ppm) is established based on ISO 8178; however, PM measurement methodology for fuel oil with sulfur content above 0.8%, such as residual fuel, is not specifically defined in the NPRM, which could create a situation where there is no accuracy or consistency in certification testing. EMA stated that it is concerned that certification testing on residual fuel may not represent in-use application. The commenter further stated that, when combined with the variability of the residual fuels that could be obtained for operation or testing, certification of engines using residual fuel likely will result in the generation of certification data that are not reflective of the operation of vessels in-use.

EMA also commented that, more importantly, the requirement for certification testing on residual fuel will amount to a de facto ban on the deployment of any residual-fueled marine engines, even auxiliary engines, in any U.S.-flagged vessels. The commenter stated that even EPA's proposal to allow some flexibility for auxiliary engines installed on vessels that utilize residual fuel (72 FR 16005) does not avoid the de facto ban on such engines. The commenter noted that the fact remains that a marine auxiliary engine cannot meet the proposed flexibility standards (1.8 g/kW-hr for NOx, and 0.5 g/kW-hr for PM) if certification testing is required on residual fuel. EMA thus stated that, if it is EPA's intent to implement a ban on all residual fuel marine engines in new U.S.-flagged vessels, that intent should be clearly expressed so that all affected stakeholders can fully understand the impacts of the proposed regulations.

CIMAC Exhaust Emission Controls Working Group and LCA noted the proposed provision that engines designed for operating on residual fuel must also show compliance with the standards and requirements in Part 1042 Subpart B (§1042.101) when operating on the actual fuel used—basically, that engines operating on residual fuel and installed not only on ships in coastal waters (auxiliary and main engines), but also on ocean-going vessels (auxiliary engines), must comply using that fuel. The commenters stated that they are concerned that residual fuel does not represent a well-defined product in terms of fuel properties (the properties vary depending on bunkering port and refinery), and thus certification of engines for a representative residual fuel quality is impractical if not impossible (the commenters questioned what kind of residual fuel quality would be used for compliance testing). CIMAC and LCA recommended that the procedure used by the International Maritime Organization (IMO) be used: certification testing on distillate fuel only, even though the actual used fuel would be residual fuel.

CIMAC and LCA commented that they are also concerned about the proposed PM measurement method, which is similar to ISO 8178 part 1; the commenters noted that the applicability of ISO 8178 part 1 is limited by the fuel sulfur content. The commenters noted that experience with the ISO 8178 method has shown low repeatability. (CIMAC also noted that the recommendation in the ISO 8178 standard is that the sulfur level when using this method should not exceed 0.8% (8000 ppm), and commented that its upper recommended limit for this method is 0.05%, (500 ppm) and, based on experience within the CIMAC EEC WG, the ISO 8178-1 method for particulates shows low repeatability together with typical marine fuel qualities. CIMAC also commented that the root cause for the low repeatability is the sulfur in the fuel.) The commenters recommended that EPA define a proper PM measurement procedure for typical marine fuel qualities before proposing (and finalizing) requirements. The commenters also recommended the use of ISO 9096 for marine engines operating on any fuel quality in order to achieve consistent measurement results and also enabling comparison to other land-based sources, because ISO 9096 is the predominant method used for measuring particulates on land-based stationary sources.

CIMAC and LCA commented that the emission standards for Category 3 (C3) propulsion engines are based on the use of residual fuel; however, auxiliary engines designed and operated on residual fuels must comply with emission standards based on the use of distillate fuel. The commenters stated that the design principle of a residual fuel-operated engine (C2 and C3) is different from that of one designed for distillate fuel use only. The commenters noted that residual fuel-designed (and operated) engines inherently emit higher PM and NOx emissions than those using distillate. CIMAC and LCA commented that the regulations must reflect these facts by employing standards tailored to those realities. The commenters stated that they believe the problem could be avoided by expanding the IMO MARPOL Annex 6 approach to Category 2 engines.

CIMAC also commented that it believes EPA should be aware of the fact that likely no engine type belonging to C2 will be certified for operation on residual fuel with the proposed conditions ("tight PM and NOx levels with Tier 2, 3 and 4 and inadequate PM measurement method"), the commenter believes that the use of residual fuel is not possible. The commenter further stated that, as a consequence U.S.-flagged ocean-going ships operating in international traffic will be excluded to operate the auxiliary engines on residual fuel - as the foreign-flagged ships will do. The commenter suggested that a better approach would be to introduce geographically-based emission standards, such as the type of regulation that California has introduced for auxiliary engines and diesel electric propulsion within California waters to regulate the fuel quality in coastal waters. CIMAC provided the following recommendations for the compliance test procedure: compliance testing on distillate fuel only, although the engine will be operated in use on any fuel quality (e.g., residual fuel); use an approach similar to that used by IMO Annex 6 to MARPOL; if compliance tests are required on the actual fuel that will be used, a proper practicable PM measurement method should be defined and ISO 9096 should be used in place of ISO 8178.

LCA also commented that it believes EPA must consider whether the cost of switching from residual to distillate fuel will encourage modal shifts. LCA commented that the nation's railroads do not have a great deal of excess capacity right now, but noted that freight rates can reach a point where at least some cargo could change modes. The commenter stated that moving cargo from the water to land produces significant increases in fuel consumption and emissions, and also has some societal impacts. The commenter stated that it believes that if more trains move through population centers, it could result in more accidents at rail crossings, and possibly even more green space covered with rail beds. The commenter suggested that EPA carefully weight the concerns.

Crowley noted that marine transportation is the most energy efficient transportation mode for moving cargo. In terms of emissions of SOx and PM per ton of cargo moved, it is comparable to other modes and its GHG emissions are significantly less than other modes. Fuel costs represent a significant portion of marine vessel operating costs. For this reason, residual fuel is the chosen fuel when operating on voyages between ports. As the cost of fuel increases, there will be a shift of tonnage from marine vessels to less energy efficient highway or rail transportation modes resulting in a higher level of emissions over land versus at sea.

The Puget Sound Clean Air Agency commented that it believes auxiliary engines should be certified distillate engines and that EPA should not relax its standards for these engines to accommodate the use of residual fuel. The commenter noted that there is a growing practice of using distillate fuel in these engines while vessels are in port; and stated that, given that auxiliary engines are used extensively while vessels are in port, often near sensitive populations, it is essential to reduce their emissions as rapidly as possible.

The Northeast States for Coordinated Air Usage Management (NESCAUM) noted the claim by shipbuilders that they are unable to obtain certified C1 or C2 residual fuel auxiliary engines for installation on newly built vessels with C3 propulsion engines and that they have requested relief from the certification requirements in this circumstance. NESCAUM commented that it supports the solution presented by EPA of requiring installation of certified auxiliary engines that operate on distillate fuel, notwithstanding the requirement for a separate fueling system on the vessel.

Letters:
Crowley Maritime Corporation OAR-2003-0190-0641
CIMAC Exhaust Emission Controls Working Group OAR-2003-0190-0548.1
Engine Manufacturers Association (EMA) OAR-2003-0190-0545
Lake Carriers' Association (LCA) OAR-2003-0190-0567.1
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2003-0190-0512
Puget Sound Clean Air Agency OAR-2003-0190-0484

Our Response:

Please see the response to section 3.2.9 regarding residual fuel engines and certification testing on residual fuels.

11.3.4 Additives and Clean Fuels

What Commenters Said:

A private citizen provided comments regarding Syntroleum's (SYNM) ultra-clean diesel fuel for test and evaluation. The commenter noted that the fuel was a synthetic fuel made from the Fischer-Tropsch process combined with Syntroleum's proprietary processes. The commenter noted that the feedstock was natural gas, but that the same fuel can be developed from coal, natural gas, or bio-mass. The commenter further stated that the coal-to-liquid is the cheapest and most abundant feedstock source in the United States because of coal reserves that could last 250 to 300 years. The commenter stated that the production of this fuel is competitive with crude oil when the crude oil is $45 to $50 per barrel, according to Syntroleum and others; and the commenter stated that his first impression has always been that this synthetic fuel can be used in existing diesel engines without any need for modifying the engine. The commenter also noted that this fuel differs from ethanol as there is currently no existing infrastructure to provide higher amounts of ethanol, and ethanol requires a special hybrid vehicle design. The commenter provided information on the characteristics and properties of Syntroleum's fuel in his comments, and noted that it meets or exceeds all CARB, EPA, and EU current and future requirements.

The commenter also provided information about the Silverado Green Fuels, Inc. (a subsidiary of Silverado Gold Mines Ltd), "Green Fuel" product that will be demonstrated in Choctaw County, Mississippi. The commenter stated that the fuel is a cleaner and safer form of fuel derived from lignite, and should be in operation within 24 months at a price of about $15/barrel.

Pure Power EcoFuel LLC and Marine Propulsion Technology, Inc. jointly announced two new fuel savings alternatives that reduce marine fuel consumption, thus dramatically reducing marine fuel emissions. The commenters noted their new "EcoFuel™ Mach 3 Gasoline & Diesel Additive." The commenters noted properties and results from independent testing. The commenters stated that the additive is affordable (only one ounce is needed for every 15 gallons of fuel), efficient (it does not produce any new/foreign material that could cause any adverse emissions), and works on all marine gas or diesel engines (and even better on the fuels used by deep-water vessels). The commenters also provided information on their new Thrustor™ and Schultz Nozzle™ Marine Propulsion Systems. The commenters stated that this marine propulsion and guidance system reduces fuel consumption, while increasing overall vessel performance. The commenters noted that prototypes have been proven out and are ready for production. The Thrustor™ marine propulsion system is designed to perform on all high speed propellers on both out-board motors and stern drive boats with planning hulls at virtually any speed; test results showed a fuel savings of 5-15% depending on motor size and speeds. The Schultz Nozzle™ marine propulsion system is designed to perform on all in board motor vessels with either displacement or planning hulls and any size propeller, and has projected fuels savings of 10-20% depending on vessel size and speed. The commenters stated that the systems are affordable and could (conservatively) provide an expected combined fuel savings of 20-40%. Pure Power EcoFuel LLC and Marine Propulsion Technology, Inc. commented that they welcome EPA's rigorous independent testing.

<u>Letters:</u>
Association of American Railroads (AAR) OAR-2003-0190-0566.1
Kirby Corporation OAR-2003-0190-0563.1
Marine Propulsion Technology, Inc. OAR-2003-0190-0720
Private CitizenOAR-2003-0190-0348
Pure Power EcoFuel, LLC OAR-2003-0190-0720

Our Response:

Our regulations are intended to be fuel neutral and would not preclude the use of these fuels or additives. However, anyone wishing to obtain a certificate of conformity that relies on the use of an additive or a fuel that is not widely available would be required to demonstrate that such additives or fuels would be used.

11.4 Alternatives

11.4.1 Alternative 1: Exclusion of Locomotive Remanufacturing Standards

What Commenters Said:

The North Kingston Community Association) and the South Coast Air Quality Management District (SCAQMD) commented that they oppose Alternative 1 (the exclusion of additional controls on older locomotive engines). SCAQMD further commented that it agrees with EPA that locomotive remanufacturing programs are needed since existing locomotives represent a significant portion of the emissions inventory.

Letters:
North Kingston Community Association OAR-2003-0190-0496
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0558.1

Our Response:

We did not chose to finalize this alternative because these remanufactured locomotive standards represent PM reductions of about 50 percent, and (for Tier 0+ locomotives with separate loop intake air cooling) NOx reductions of about 20 percent. Significantly, these reductions will be substantial in the early years. This will be important to State Implementation Plans (SIPs) being developed to achieve attainment with the NAAQS, owing to the 2008 start date and relatively rapid remanufacture schedule (roughly every 7 years, though it varies by locomotive model and age). Therefore, we agree with the North Kingston Community Association and as proposed, we are setting new standards for the existing fleet of Tier 0, Tier 1, and Tier 2 locomotives, to apply at the time of remanufacture. These standards will also apply at the first remanufacture of Tier 2 locomotives added to the fleet between now and the start of Tier 3.

11.4.2 Alternative 2: Tier 4 Advanced One Year

What Commenters Said:

The Passenger Vessel Association (PVA) commented that, with regard to Alternative 2 (Tier 4 advanced one year), it does not believe that the advancement of Tier 4 standards by one year is achievable or desirable given the unknowns introduced by current marine experience in aftertreatment utilization. However, SCAQMD commented that it does not agree with EPA that advancing Tier 4 standards is not feasible. The commenter further stated that it believes that Tier 4 standards are achievable as early as 2010 (and the commenter proposed that the Tier 4 standards be implemented by June 2012).

Letters:

Passenger Vessel Association (PVA) OAR-2003-0190-0507
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0483

Our Response:

We have considered the many comments we received supporting our proposed marine engine standards and timing, or arguing for different standards/timing. Many state and local air quality agencies and environmental organizations argued that earlier implementation of Tier 4 technologies is feasible and emphatically needed to address the nation's air quality problems. Some pointed to advanced technology demonstrations already being made on marine vessels. We have reviewed the available information provided in comments and elsewhere and have concluded that the standards and timing we are adopting in the final rule, which include some modifications from the proposal, are feasible and appropriate under the Clean Air Act. We note that some of the modifications from the proposal, such as a pull-ahead of Tier 4 NOx for 2000-3700 kW engines, involve an increase in stringency. In these cases our own feasibility analysis is supported by manufacturer comments. See section 3.2.1 "Timing and Standards for the Overall Program," section 10.3.1 "Lead Time for Marine" of this document, and section III.B.(2)(a) of the preamble to the final rule for further information on our finalized provision to pull Tier 4 NOx standards for 2,000-3,700 kW engines ahead by two years.

11.4.3 Alternative 3: Tier 4 Exclusively in 2013

What Commenters Said:

SCAQMD commented that it has reviewed the alternatives analyzed in the NPRM and it does not concur with EPA's presumption that under Alternative 3 (setting Tier 4 standards by 2013), concurrent efforts cannot be made to have a remanufactured and a new engine program. The commenter noted that there are efforts currently underway to field demonstrate particulate filter devices on switch locomotives and diesel oxidation catalysts on line-haul locomotives. The commenter further noted that, as described in EPA's own documents, these technologies are commercially available in Europe for new switch locomotives and a particulate filter device has been integrated into a 3500 hp line-haul locomotive. Additionally, SCAQMD commented that its understanding is that there are currently two locomotives that meet the proposed Tier 3 standard.

SCAQMD noted that, relative to NOx control technologies, it is sponsoring two field demonstrations of SCR/DPF technologies on passenger trains; and the commenter strongly believes that these demonstrations will be applicable to switch and line-haul locomotives. The commenter noted that its understanding is that there are about 60 locomotive configurations that the manufacturers must ultimately develop remanufacture kits to meet the proposed remanufacture standards; many of these configurations are similar in design and manufacturers could develop kits for a family of engine configurations. SCAQMD commented that locomotive engine manufacturers have been working on parallel efforts to produce remanufacture kits and bringing new Tier 2 engines to the market. The commenter stated that it believes that the challenge facing manufacturers in having both programs is not one of technology but rather, simply a matter of applying additional engineering resources.

SCAQMD commented that it would support alternative proposals as long as it is demonstrated that the alternative proposal achieves emission reductions equivalent to the SCAQMD staff proposal. The commenter urged EPA to, at a minimum, consider its proposed Tier 4 deadlines to apply only to California; the commenter believes that a regional rule can serve as a 'push ahead' demonstration of Tier 4 locomotives that will benefit the rest of the nation.

SCAQMD commented that it understands that proposals have been made to EPA to accelerate EPA's proposed Tier 4 NOx standards by two years (from 2017 to 2015) and require a 50 percent reduction in NOx under the proposed Tier 3 standard. The commenter stated that it believes that, while this would provide some additional emission reduction benefits, it would not be sufficient to meet the needs of the South Coast Basin and other areas where significant locomotive activities occur. The commenter noted that under this proposal, Tier 4 locomotives would still not be available prior to the year that the South Coast Basin must demonstrate attainment of the federal $PM_{2.5}$ standard. The commenter additionally stated that this proposal does not achieve the emission reductions that the California Air Resources Board targeted in the California SIP (which calls for 30 percent penetration of Tier 4 locomotives by 2014). SCAQMD noted that in the past, the Class 1 railroads have agreed to accelerate penetration of new Tier 2 locomotives in the South Coast Basin, a mechanism which could help achieve the reductions proposed by CARB and needed to timely attain the federal standards if EPA requires manufacture of Tier 4 locomotives at an early enough date.

SCAQMD commented that while it recommends advancing Tier 4 standards to June 2012, it believes that this alternative is the closest alternative to the SCAQMD staff comment. However, the commenter stated, if EPA decides to advance Tier 4 standards to 2013, the remanufacture locomotive programs must remain in place—as remanufacture locomotive programs are critical to expeditious emission reductions. SCAQMD reiterated that its recommendation is to implement new Tier 3 standards by the end of 2010 and require remanufacturing of Tier 2 locomotives by 2010.

The North Kingston Community Association commented that it opposes Alternative 3 (eliminating immediate (Tier 3) controls on large new engines). The commenter stated that the technology for these already exists and these alternatives considerably weaken EPA's proposal. The commenter stated that it forgoes the opportunity of considerable air quality improvement with minimal additional cost.

Letters:
North Kingston Community Association OAR-2003-0190-0496
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0483 (hearing), 0558.1

Our Response:

The proposed Alternative 3 evaluated eliminating the Tier 3 standards along with the locomotive remanufacturing standards, while pulling the Tier 4 standards ahead to 2013 for all portions of the Tier 4 program.2 We agree with the commenters that the elimination of Tier 3 and the locomotive remanufacturing program as this alternative describes would substantially reduce essential near-term benefits, and would provide significantly fewer PM reductions. We believe our Final Rule, which pulls ahead Tier 4 NOx standards two years combined with our new locomotive and marine remanufacturing standards is a superior program to this alternative.

Regarding the comment that we could pull the Tier 4 standards forward while maintaining the proposed new remanufacturing standards, as we stated in the NPRM, we still do not believe that it is reasonable to project that such an approach is feasible. The remanufacturing program is extensive and will demand a substantial amount of resources from locomotive manufacturers in 2008 and 2009 in order for them to meet the standards on over sixty different engine configurations subject to this program that will all require testing and certification in order to meet the 2010 requirement for Tier 0 and Tier 1 and the 2013 requirement for Tier 2. We do not believe that manufacturers would have enough available engineering staff, engine test cells, and engineering facilities to introduce Tier 4 as early as this Alternative proposed while simultaneously upgrading their remanufacturing systems. SCAQMD suggests that it is "simply a matter of applying engineering resources" to accomplish this. However, unlike the situation for smaller diesel engines, where manufacturers can leverage their own resources by contracting with independent testing labs, locomotive manufacturers must perform nearly all development testing in their own facilities. There is limited additional testing capability available. The situation is similar for large marine engines. Moreover, introducing fundamentally new technologies into either rail or marine service requires substantial field testing before they can be introduced more broadly. To require widespread use of Tier 4 technologies by locomotives and large marine engines in 2012 would have required that manufacturers had prototypes ready for testing several years prior to 2012, which would be infeasible at this point..

11.4.4 Alternative 4: Elimination of Tier 4

What Commenters Said:

The North Kingston Community Association commented that it opposes Alternative 4 (the elimination of advanced (Tier 4) technology on large new engines). The commenter stated that it believes that Alternative 4 denies the public the advantages of new technology; the commenter believes that new emission technologies have almost always ultimately benefited American Industry, as well as provided the public with the best air quality benefits possible. SCAQMD commented that it agrees with EPA that Tier 4 standards are necessary, and stated

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2 Note that the equivalent alternative for the Final Rule is Alternative 4, which evaluates this scenario without new remanufacturing standards for either marine or locomotives.

that it does not support the elimination of the proposed Tier 4 standards. (Also, as noted in previous chapters of this Summary and Analysis of Comments document, SCAQMD stated that it believes that the timing for implementation of the proposed Tier 4 standards could be advanced to the 2012 timeframe and would provide greater emission reductions required for $PM_{2.5}$ attainment.)

Letters:
North Kingston Community Association OAR-2003-0190-0496
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0558.1

Our Response:

We agree with the commenter that the elimination of Tier 4 would produce a program that falls well short of the total benefits that our comprehensive proposed program was expected to realize. Elimination of Tier 4 would result in a substantial loss of PM emission reductions, and well over half of the NOx reductions expected. Therefore, our final program includes Tier 4 standards.

11.4.5 Alternative 5: Standards for Engines on Existing Marine Vessels

What Commenters Said:

The North Kingston Community Association and Friends of the Earth commented that they support the overall structure of Alternative 5 (setting Tiers 3 and 4 standards for most large commercial marine engines and cleaning up existing marine engines when they are remanufactured). The North Kingston Community Association also commented that it favors Alternative 5 because, to a large extent, it uses existing technology and provides major air quality benefits.

Clean Air Task Force (CATF) noted that Alternative 5 would require a ‘minimal’ 25% PM reduction for remanufactured marine engines above 800 hp. The commenter stated, however, that EPA indicated an expectation that the simple application of locomotive remanufacturing kits to similar marine engines could reduce PM emissions by up to 60% and NOx emissions by 25%. CATF commented that it believes EPA should require remanufactured marine engines to meet these tighter limits and consider the application of these standards to all marine propulsion engines (the vast majority of which are below 800 hp).

The Passenger Vessel Association (PVA) commented that it believes that this discussion is fraught with reference to other programs - locomotives and buses, alternative sources - locomotive kits, eventual development of kits by manufacturers, directed kit development based on engine populations, speculative reductions of 60%, 40% and 20%, multiple certification responsibilities -engine manufacturers, aftermarket manufacturers, a fleet owner. The commenter further stated that the ‘unknowns,’ ‘maybes,’ and ‘hoped for’s’ in the preamble discussion supports the need for a separate development effort both in continued public/private discussion and in the rulemaking process.

The Washington State Department of Transportation (WSDOT) and the Washington State Ferry System (WSF) commented that they believe it is essential (for WSF) that the EMD 710 and 645 series and GE 7FDM series propulsion engines are included in the high volume marine diesels list noted in Alternative 5. The commenters noted that these are the large propulsion engines that power the majority of WSF's fleet. The commenters stated that they anticipate that the extensive work being accomplished in the locomotive sector will carry over into viable solutions for marine sector propulsion engines. The commenters also stated that, to assess the impact of addressing all engines as an onboard system (as discussed in Marine Diesel Engines to Be Included in the Program), WSF estimates a high implementation cost. The commenters noted that most of the WSF ferries have multiple auxiliary generators that fall below the 800 hp cut off normal operations, and that WSF has proactively replaced many of these diesels with Tier 1 compliant Detroit Diesel Corporation Series 60 diesels during 2002-2004 as both fuel conservation and emissions reduction initiatives. WSDOT and WSF commented that, in order to meet the proposed regulations, further engine upgrades and exhaust aftertreatment will be needed (and the commenters stated that costs for such upgrades have not been factored into their estimate as it is focused on meeting the proposed requirements of Alternative 5).

SCAQMD commented that its staff fully supports setting remanufacturing requirements for marine engines similar to the locomotive remanufacturing standards, per Alternative 5. The commenter stated that it believes that the proposed remanufacturing program should apply to pre-1973 model engines and to all Category 1 and 2 marine engines, and (as acknowledged in the preamble) the pre-1973 marine engines account for over one-third of the population of marine engines which are not systematically retired. The commenter further noted that marine engines less than 600 kW contribute nearly 40 percent of the emissions to the South Coast Air Basin harbor craft sector. The commenter stated that, for these reasons—and to develop an effective reduction strategy for existing marine engines—it recommends the applicability of the remanufacturing requirements to all engine sizes and model years.

The Texas Commission on Environmental Quality (TCEQ) commented that, in response to EPA's request for comment on whether to set emission standards for existing large marine diesel engines when they are remanufactured, it supports establishing emission standards for remanufactured compression ignition marine engines with per-cylinder displacement below 30.0 liters per cylinder that would be similar to the emission standards proposed for remanufactured and/or refurbished locomotive engines.

Letters:

Clean Air Task Force OAR-2003-0190-0499
North Kingston Community Association OAR-2003-0190-0496
Passenger Vessel Association (PVA) OAR-2003-0190-0507
South Coast Air Quality Management District (SCAQMD) OAR-2003-0190-0483
Texas Commission on Environmental Quality OAR-2003-0190-0612.1

Washington State Department of Transportation (WSDOT) & Washington State Ferry System (WSF) OAR-2003-0190-0555.2

Our Response:

EPA agrees with these commenters about the need to address emissions from engines in the existing fleet of marine vessels that will not be subject to the new Tier 3 and Tier 4 standards. We also agree that such a program should take into account the special operating and technical challenges associated with marine diesel engines, and we consulted with engine manufacturers and users to obtain their feedback on key elements of the program. The remanufacture program we are finalizing is important step toward reducing emissions from the engines that are in the marine fleet the longest and that are the largest contributors to diesel marine air pollution.

In response to comments by CATF suggesting that our program should require greater emissions reductions, section 9.10 of this document discusses why the standard we are adopting for marine remanufacture systems is a 25 percent reduction in measured PM emissions and no increase in NOx emissions (within 5 percent) which is similar to the PM emission reduction that was achieved from our Tier 2 marine diesel engine standards for new engines. PVA noted that this program relies heavily on other existing engine programs and as such, continued discussion and/or a separate rulemaking process may be necessary to develop a marine remanufacture program. We do not think it is necessary to postpone adoption of these standards to a separate rulemaking because the program we are finalizing is a market-based program that relies on the voluntary certification of remanufacture systems, see section 9.6 for more details on this subject. WSDOT commented that certain engine models must be included on our high volume engine list of engines which would be required to have remanufacture kits available as described in part 2 of Alternative 5. Part 2 of Alternative 5 included a set of mandatory standard, however, we are not finalizing part 2 of Alternative 5, see section 9.3 for more information on why we are only finalizing part 1 of Alternative 5 at this time. WSDOT also commented on the high implementation cost of addressing all engines as an onboard system. The NPRM discussed the idea of the 600 kW cutoff point including vessels with total power of 600 kW or greater and was listed as a potential modification to Alternative 5, however, it was not part of the proposed Alternative, and is not part of our final rulemaking, see section 9.7 for more discussion about which engines are covered by our final rulemaking and why. SCAQMD commented that all marine engines should be covered by this program regardless of size or age, section 9.7 of this document also discusses why our final rulemaking only covers engines greater than 600 kW that were built after 1972. Finally, TCEQ commented that it supports establishing standards that are similar to those for remanufactured locomotives. We expect that the program we are finalizing will utilize locomotive remanufacture systems on marine engines derived from locomotive engines and have included provisions in our final rule to streamline the certification process for locomotive remanufacture kits to be used on marine engines, see sections 9.3 and 9.11 for more details.