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

Chapter 3
Emission Standards

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

United States
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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.

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:

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.

Letters:
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.

Letters:
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.

Letters:
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:

Set Accelerated, More Stringent, or Expanded Standards

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.

Do Not Set Accelerated, More Stringent, or Expanded Standards

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.

Letters:
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.

Letters:
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.

Letters:
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.

Letters:
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.

Letters:

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.