production line testing program. For example, given the small sales volumes associated with marine engines it may be appropriate to include a production verification program for marine engines as part of a manufacturer's broader production verification programs for its non-marine engines. We believe these existing provisions already address the concerns raised to us by the manufacturers.

We are adding provisions to allow manufacturers to use special procedures for production line testing of catalyst-equipped engines. Under the existing Part 92 and Part 94 programs, a manufacturer of a catalyst-equipped locomotive or Category 2 marine engine would be required to assemble and test the engine with a complete catalyst system. At the manufacturer's choice, the engine could be broken in by operating it for up to 300 hours or it could be tested in a ''green'' state and its measured emissions adjusted by applying ''green engine factors''. The new regulations in Parts 1033 and 1042 will continue to allow these options, but will also include additional options.

For locomotives, the new regulations will allow a locomotive to be used in service for up to 1,000 hours before it is tested. This will be sufficient time to degreen a catalyst. We believe that this approach should work well for locomotives given the very close working relationships between the manufacturers and the major railroads. (See section 0 for additional interim provisions related to production-line testing of locomotives.)

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

(12) Evaporative Emission Requirements

While nearly all locomotives currently subject to part 92 are fueled with diesel fuel, § 92.7 includes evaporative emission provisions that would apply for locomotives fueled by a volatile liquid fuel such as gasoline or ethanol. These regulations do not specify test procedures or specific numerical limits, but rather set ''good engineering'' requirements. We are adopting these same requirements in part 1033.

We are also adopting similar requirements for marine engines and vessels that run on volatile fuels. We are not aware of any compression-ignition marine engines currently being produced that would be subject to these requirements but believe that it is appropriate to adopt these requirements now rather than waiting until such engines are produced. In this final rule, we are adopting requirements for controlling evaporative emissions that are identical to those for locomotives. As described in the proposal, we intend to apply to compression-ignition marine engines and vessels the same requirements we will be adopting for spark-ignition engines and vessels before the end of 2008 (as proposed at 72 FR 28098). We therefore intend to modify part 1042 in the final rule corresponding to that proposal related to spark-ignition marine engines and vessels. Specifically, if someone were to build a marine vessel with a compression-ignition engine that runs on a volatile liquid fuel, the engine would be subject to the exhaust emission standards of part 1042, but the fuel system would be subject to the evaporative emission requirements of the recently proposed part 1045.[160]

(13) Small Business Provisions

There are a number of small businesses that will be subject to this rule because they are locomotive manufacturers/remanufacturers, railroads, marine engine manufacturers, post-manufacture marinizers, vessel builders, or vessel operators. We largely continue the existing provisions that were adopted previously for these small businesses in the 1998 Locomotive and Locomotive Engines Rule (April 16, 1998; 63 FR 18977); our 1999 Commercial Marine Diesel Engines Rule (December 29, 1999; 64 FR 73299) and our 2002 Recreational Diesel Marine program (November 8, 2002; 67 FR 68304). These provisions, which are discussed below, are designed to minimize regulatory burdens on small businesses needing added flexibility to comply with emission standards while still ensuring the greatest emissions reductions achievable. (See section IX.C of this rule for discussion of our outreach efforts with small entities.)

(a) Locomotive Sector

(i) Production-Line and In-Use Testing Does not Apply

Production-line and in-use testing requirements do not apply to small locomotive manufacturers until January 1, 2013, which is up to five calendar years after this program becomes effective.

In the 1998 Locomotive Rule (April 16, 1998; 63 FR 18977), the in-use testing exemption was provided to small remanufacturers with locomotives or locomotive engines that became new during the 5-year delay, and this exemption was applicable to these locomotives or locomotive engines for their entire useful life (the exemption was based on model years within the delay period, but not calendar years as we are promulgating today). As an amendment to the existing in-use testing exemption, small remanufacturers with these new locomotives or locomotive engines must now begin complying with the in-use testing requirements after the five-year delay on January 1, 2013 (exemption based on calendar years). Thus, they are no longer exempt from in-use testing for the entire useful life of a locomotive or a locomotive engine. We are finalizing this provision to ensure that small remanufacturers comply with our standards in-use, and subsequently, the public is assured they are receiving the air quality benefits of today's standards. In addition, this amendment provides a date certain for small remanufacturers when in-use testing requirements begin to apply.

We received a number of comments asking us to clarify whether or not we were still planning to require production-line audits or verification for small locomotive remanufacturers during this 5-year delay (until January 1, 2013). In response, we are clarifying that we did not intend to exempt small locomotive remanufacturers from production-line audits during the 5-year delay (our intent was to exempt these entities from production-line and in-use testing requirements). We believe this requirement is of minimal regulatory burden to small locomotive remanufacturers. Moreover, we have clarified the general auditing regulations to explicitly allow audits to be conducted by the owner/operator, which further minimizes the burden.

(ii) Class III Railroads Exempt From New Standards for Existing Fleets

EPA is limiting the category of small railroads which are exempt from the Tier 0, 1 and 2 remanufacturing requirements for existing fleets to those railroads that qualify as Class III railroads and that are not owned by a large parent company. Under the current Surface Transportation Board classification system, this exemption is limited to railroads having total revenue less than $25.5 million per year. This change requires that all Class II

[160] Part 1045 was proposed on May 18, 2007 (72 FR 28097).

railroads, when remanufacturing their locomotives, meet the new standards finalized for existing fleets.

EPA had requested comment on whether the small railroads exemption from emissions standards for existing fleets had been effective and appropriate and whether they should continue under the new program finalized today. Under part 92, only railroads qualifying as ''large'' businesses, as defined by the Small Business Administration (SBA) were subject to the standards for their pre-existing fleet. The SBA definition of a large railroad is based on employment. For line-haul railroads the threshold is 1,500 or more employees, and for short-haul railroads it is 500 or more employees. Additionally, any railroad owned by a parent company that is large by SBA definition is also subject to the current existing fleet requirements. Although this excludes a majority of the more than 500 U.S. freight railroads, it addresses the vast majority of the emissions because it includes all Class I railroads.

The majority of comments supported revising the criterion for exempting railroads from emissions standards for existing fleets. While some of these commenter's felt that a revenue based approach exempting Class III railroads was appropriate, others disagreed, and argued that all railroads, regardless of classification or revenues should be subject to the new emission standards for existing fleets. These commenters felt no exemption would be legitimate because of both the extremely long operational life of these locomotive engines and the predominance of Class II and III railroads in various nonattainment areas of the country which contribute to air quality problems. Those commenters opposing any change to the existing exemption scheme argued that the current approach of exempting all small railroads should be retained because the costs involved in meeting new standards for existing fleets would impose a heavy financial burden on small railroads currently exempt from the program. Additionally, these commenters argued that small railroads' emissions are trivial and do not impact air quality.

In finalizing this new approach, EPA believes that continuing to exempt Class III railroads with annual revenues under $25.5 million while including all Class II railroads in the existing fleet program is a reasonable approach that addresses both industry concerns regarding costs while also recognizing that small railroads do contribute to air pollution in areas they service including nonattainment areas throughout the U.S.

We are clarifying our definition that intercity passenger or commuter railroads are not included as railroads that are small businesses because they are typically governmental or are large businesses. Due to the nature of their business, these entities are largely funded through tax transfers and other subsidies. Thus, the only passenger railroads that could qualify for the small railroad provisions will be small passenger railroads related to tourism.

(iii) Small Railroads Excluded From In-Use Testing Program

The railroad in-use testing program continues to apply to Class I freight railroads only, and thus no small railroads are subject to this testing requirement. It is important to note many Class II and III freight railroads qualify as small businesses. This provision provides flexibility to all Class II and III railroads, which includes small railroads. All Class I freight railroads are large businesses.[161]

(iv) Hardship Provisions

Section 1068.245 of the existing regulations in title 40 contains hardship provisions for engine and equipment manufacturers, including those that are small businesses. We will apply this section for locomotives as described below.

Under the unusual circumstances hardship provision, locomotive manufacturers may apply for hardship relief if circumstances outside their control cause their failure to comply and if the failure to sell the subject locomotives will have a major impact on the company's solvency. An example of an unusual circumstance outside a manufacturer's control may be an ''Act of God,'' a fire at the manufacturing plant, or the unforeseen shut down of a supplier with no alternative available. The terms and time frame of the relief depend on the specific circumstances of the company and the situation involved. As part of its application for hardship, a company is required to provide a compliance plan detailing when and how it will achieve compliance with the standards.

(b) Marine Sector

(i) Revised Definitions of Small-Volume Manufacturer and Small-Volume Boat Builder

As proposed, we are revising the definitions of small-volume manufacturer (SVM) and small-volume boat builder to include worldwide production. Currently, an SVM is defined as a manufacturer with annual U.S.-directed production of fewer than 1,000 engines (marine and nonmarine engines), and a small-volume boat builder is defined as a boat manufacturer with fewer than 500 employees and with annual U.S.-directed production of fewer than 100 boats. By including worldwide production in these definitions, we prevent a manufacturer or boat builder with a large worldwide production of engines or boats, or a large worldwide presence, from receiving relief from the requirements of this program. The provisions that apply to small-volume manufacturers and small-volume boat builders as described below are intended to minimize the impact of this rule for those entities that do not have the financial resources to quickly respond to requirements in the rule.

(ii) Broader Engine Families and Testing Relief

Broader engine families: We are finalizing as proposed the provision that post-manufacture marinizers (PMMs) and SVMs be allowed to continue to group all commercial Category 1 engines into one engine family for certification purposes, all recreational engines into one engine family, and all Category 2 engines into one family. As with existing regulations, these entities are responsible for certifying based on the ''worst-case'' emitting engine. This approach minimizes certification testing because the marinizer and SVMs can use a single engine in the first year to certify their whole product line. In addition, marinizers and SVMs may then carry over data from year to year until changing engine designs in a way that might significantly affect emissions.

As described in the proposal, this broad engine family provision still requires a certification test and the associated burden for small-volume manufactures. We realize that the test costs are spread over low sales volumes, and we recognize that it may be difficult to determine the worst-case emitter without additional testing but we need a reliable, test-based, technical basis to issue a certificate for these engines. However, manufacturers will be able to use carryover test data to spread costs over multiple years of production.

Production-line and deterioration testing: In addition, as proposed, SVMs producing engines less than or equal to 600 kW (800 hp) are exempted from production-line and deterioration testing for the Tier 3 standards. We will assign a deterioration factor for use in

[161] U.S. EPA, Assessment and Standards Division, Memorandum from Chester J. France to Alexander Cristofaro of U.S. EPA's Office of Policy, Economics, and Innovation, Locomotive and Marine Diesel RFA/SBREFA Screening Analysis, September 25, 2006.

calculating end-of-useful life emission factors for certification. This approach minimizes compliance testing since production-line and deterioration testing is more extensive than a single certification test. As described in the proposal, Tier 3 standards for these engines are not expected to require the use of aftertreatment—similar to the existing Tier 1 and Tier 2 standards. The Tier 4 standards for engines greater than 600 kW are expected to require aftertreatment emission-control devices. Currently, we are not aware of any SVMs that produce engines greater than 600 kW, except for one marinizer that plans to discontinue their production in the near future.[162]

We are finalizing provisions that require SVMs to undertake production-line and deterioration testing in the future if they begin producing these larger engines due to the sophistication of manufacturers that produce engines with aftertreatment technology. We believe these manufacturers will have the resources to conduct both the design and development work for the aftertreatment emission-control technology, along with production-line and deterioration testing.

(iii) Delayed Standards

One-year delay: As described in the proposal, post-manufacture marinizers (PMMs) generally depend on engine manufacturers producing base engines for marinizing. This can delay the certification of the marinized engines. There may be situations in which, despite its best efforts, a marinizer cannot meet the implementation dates, even with the provisions described in this section. Such a situation may occur if an engine supplier without a major business interest in a marinizer were to change or drop an engine model very late in the implementation process or was not able to supply the marinizer with an engine in sufficient time for the marinizer to recertify the engine. Based on this concern, we are finalizing as proposed to allow a one-year delay in the implementation dates of the Tier 3 standards for post-manufacture marinizers qualifying as small businesses (the definition of small business, not SVM, used by EPA for these provisions for manufacturers of new marine diesel engines—or other engine equipment manufacturing—is 1,000 or fewer employees; as defined by the Small Business Administration's (SBA) regulations at 13 CFR 121.201) and producing engines less than or equal to 600 kW (800 hp).

As described above and in the proposal, the Tier 4 standards for engines greater than 600 kW (800hp) are expected to require aftertreatment emission-control devices. We will not apply this one-year delay to small PMMs that begin marinizing these larger engines in the future due to the sophistication of entities that produce engines with aftertreatment technology. We expect that the large base engine manufacturer (with the needed resources), not the small PMM, will conduct both the design and development work for the aftertreatment emission-control technology and that they will also take on the certification responsibility in the future. Thus, the small PMM marinizing large engines will not need a one-year delay.

Three-year delay for not-to-exceed (NTE) requirements: As described in the proposal, additional lead time is also appropriate for PMMs to demonstrate compliance with NTE requirements. Their reliance on another company's base engines affects the time needed for the development and testing work needed to comply. Thus, as proposed, PMMs qualifying as small businesses and producing engines less than or equal to 600 kW (800hp) may also delay compliance with the NTE requirements by up to three years, for the Tier 3 standards. Three years of extra lead time (compared to one year for the primary certification standards) is appropriate considering their more limited resources. As described above and in the proposal, the Tier 4 standards for engines greater than 600 kW are expected to require aftertreatment emission-control devices. We do not apply this three-year delay to small PMMs that begin marinizing these larger engines in the future due to the sophistication of entities that produce engines with aftertreatment technology. We expect that the large base engine manufacturer (with the needed resources), not the small PMM, will conduct both the design and development work for the aftertreatment emission-control technology and that they will also take on the certification responsibility in the future. Thus, the small PMM marinizing large engines does not need a three-year delay for compliance with the NTE requirements.

Five-year delay for recreational engines: For recreational marine diesel engines, the existing regulations (2002 Recreational Diesel Marine program; November 8, 2002, 67 FR 68304) allow small-volume manufacturers up to a five-year delay for complying with the standards. However, as proposed, we will not continue this provision. As discussed above and in the proposal, the Tier 3 standards for these engines are expected to be engine-out standards which do not require the use of aftertreatment—similar to the existing Tier 1 and Tier 2 standards. The Tier 4 standards will not apply to recreational engines. Also, Tier 3 engines are expected to require far less in terms of new hardware, and in fact, are expected to only require upgrades to existing hardware (i.e., new fuel systems). In addition, manufacturers have experience with engine-out standards from the existing Tier 1 and Tier 2 standards, and thus, they have learned how to comply with such standards. Thus, small-volume manufacturers of recreational marine diesel engines do not need more time to meet the new standards. For small PMMs of recreational marine diesel engines, the one-year delay described earlier will provide enough time for these entities to meet today's standards.

(iv) Engine Dressing Exemption

We are finalizing as proposed that marine engine dresser will continue to be exempt from certification and compliance requirements. As described in the proposal, many marine diesel engine manufacturers take a new, land-based engine and modify it for installation on a marine vessel. Some of these companies modifying an engine make no changes that might affect emissions. Instead, the modifications may consist of adding mounting hardware and a generator or reduction gears for propulsion. It can also involve installing a new marine cooling system that meets original manufacturer specifications and duplicates the cooling characteristics of the land-based engine but with a different cooling medium (such as sea water). In many ways, these manufacturers are similar to nonroad equipment manufacturers that purchase certified land-based nonroad engines to make auxiliary engines. This simplified approach of producing an engine can more accurately be described as dressing an engine for a particular application. As indicated above, engine dressers make changes to an engine without affecting the emission characteristics of the engine, which would include modifications that do not affect aftertreatment emission-control devices or systems (as stated earlier, Tier 4 standards for engines greater than 600 kW (800 hp) are expected to require aftertreatment).

Because the modified land-based engines are subsequently used on a marine vessel, however, these modified engines are considered marine diesel

[162] U.S. EPA, Assessment and Standards Division, Memorandum from Chester J France to Alexander Cristofaro of U.S. EPA's Office of Policy, Economics, and Innovation, Locomotive and Marine Diesel RFA/SBREFA Screening Analysis, September 25, 2006.

engines, which then fall under these requirements. As described in the proposal, while we continue to consider them to be manufacturers of a marine diesel engine, they are not be required to obtain a certificate of conformity (as long as they ensure that the original label remains on the engine and report annually to EPA that the engine models that are exempt pursuant to this provision). This extends section 94.907 of the existing regulations. For further details of engine dressers responsibilities see section 1042.605 of the regulations.

(v) Vessel Builder Provisions

Current recreational marine engines regulations (2002 Recreational Diesel Marine program; November 8, 2002, 67 FR 68304) allow manufacturers with a written request from a small-volume boat builder to produce a limited number of uncertified engines (over a five year period)—an amount equal to 80 percent of the boat builders sales for one year. For builders with very small production volumes, this 80 percent allowance could be exceeded, as long as sales did not exceed 10 engines in any one year nor 20 total engines over five years and applied only to engines less than or equal to 2.5 liters per cylinder. We are not continuing this provision because recreational marine engines are subject only to the Tier 3 standards that are not expected to change the physical characteristics of engines (Tier 3 standards will not result in a larger engine or otherwise require any more space within a vessel). Because of the similarity to Tier 2 engine standards there will be no need for boat builders to redesign engine compartments thus eliminating the need for this 5 year delay provision.

(vi) Small Vessel Operators Exempt From New Standards for Existing Fleet

In the proposed rule, we requested comment on an alternative program option (Alternative 5: Existing Engines) that would for the first time set emission standards for marine diesel engines on existing vessels—the marine existing fleet or remanufacture program. As described earlier in section III.B.2.b, Remanufactured Marine Standards, we plan to finalize only the first part of this option requiring the owner of a marine diesel engine (vessel operator) to use a certified marine remanufacture system when the engine is remanufactured if such a system is available.

The marine existing fleet program will apply only to those commercial marine diesel engines (C1 and C2 engines) which meet the following criteria:

- Greater than 600 kW (800 hp);
- Tier 0 or Tier 1 engines for C1 engines;
- Tier 0, Tier 1 or Tier 2 engines for C2 engines;
- Built in model year 1973 or later; and
- Have a certified kit available at time of remanufacture.

We estimate that about 4 percent (or about 3,885 of 105,406 engines) of all C1 and C2 engines are subject to the existing fleet program and are likely to have certified kits available at the time of remanufacture. Thus, the percentage of vessels impacted by the remanufacture program is estimated to be similar.

Industry commented that a small portion of the vessel operators with engines greater than 600 kW (800 hp) are small businesses that would be significantly burdened by the existing fleet program. To address these comments, the requirements of the marine existing fleet program do not apply to owners of marine diesel engines or vessel operators with less than $5 million in gross annual sales revenue. This threshold includes annual sales revenue from parent companies or affiliates of the owners/operators. (Small Business Administration's (SBA's) regulations at 13 CFR 121.103 describe how SBA determines affiliation.) If at some future date gross annual sales revenues are $5 million or more, they become subject to the existing fleet program at that point. The $5 million limit was chosen because a substantial sample of data for vessel operators—with vessels that have C1 and C2 engines greater than 600 kW—indicates that a significant portion of the total revenue for this sample set, about 80 percent, is generated by operators with $5 million or more in annual sales revenue.[163]

We expect that the amount of emissions from this sector correlates reasonably well with the amount of revenue generated (anticipate that revenue corresponds to activity which correlates well to emissions), and thus, most of the emissions from vessel operators (with engines greater than 600 kW (800 hp)) is obtained from those operators with $5 million or greater in revenue. The $5 million threshold for annual sales revenue is estimated to include about 8 percent less of the total vessel operator revenue compared to a $10 million limit, while reflecting 15 percent more revenue than a $1 million threshold. About 90 percent of all vessel operators with C1 and C2 engines have less than $5 million in revenue. The cost to remanufacture engines is a greater burden to the vessel operators with less than $5 million in revenue (larger fraction of revenue, etc.) than those above this limit. Therefore, the $5 million revenue threshold eliminates the regulatory burden for a substantial number of small vessel operators, while capturing a significant portion of the emissions from operators in the marine remanufacture program.

[163] The Waterways Journal, Inc., 2006 Inland River Record.

(vii) Hardship Provisions

Sections 1068.245, 1068.250 and 1068.255 of the existing title 40 regulations contain hardship provisions for engine and equipment manufacturers, including those that are small businesses. As proposed, we will apply these sections for marine applications such as PMMs, SVMs, and small-volume boat builders, which will effectively continue existing hardship provisions for these entities as described below.

In addition, for the marine existing fleet or remanufacture program, we are now providing these same hardship provisions to vessel operators or marine remanufacturers that qualify as small businesses. These provisions are described below.

Post-Manufacture Marinizers (PMMs), Small-Volume Manufacturers (SVMs), and Vessel Operators (or Marine Remanufacturers): As proposed, we are continuing two existing hardship provisions for PMMs and SVMs. In addition, we now extend these two provisions to small vessel operators or small marine remanufacturers for the marine existing fleet program. All of these entities may apply for this relief on an annual basis. First, under an economic hardship provision, PMMs, SVMs, and vessel operators (or marine remanufacturers) may petition us for additional lead time to comply with the standards. They must show that they have taken all possible business, technical, and economic steps to comply, but the burden of compliance costs will have a major impact on their company's solvency. As part of its application of hardship, a company is required to provide a compliance plan detailing when and how it plans to achieve compliance with the standards. Hardship relief could include requirements for interim emission reductions and/or purchase and use of emission credits. The length of the hardship relief decided during initial review is up to one year, with the potential to extend the relief as needed. We anticipate that one to two years is normally sufficient. Also, for PMMs and SVMs, if a certified base engine is available, they must generally use this engine. We believe this provision will protect PMMs and SVMs from undue hardship due to certification burden. Also, some emission reduction can be gained if a certified base engine becomes available. See the regulatory text in 40 CFR 1068.250 for additional information.

Second, under the unusual circumstances hardship provision, PMMs, SVMs, and vessel operators (or marine remanufacturers) may also apply for hardship relief if circumstances outside their control cause the failure to comply and if the failure to sell the subject engines will have a major impact on their company's solvency. An example of an unusual circumstance outside a manufacturer's control may be an ''Act of God,'' a fire at the manufacturing plant, or the unforeseen shut down of a supplier with no alternative available (the second example is mainly for PMMs and SVMs). The terms and time frame of the relief depend on the specific circumstances of the company and the situation involved. As part of its application for hardship, a company is required to provide a compliance plan detailing when and how it will achieve compliance with the standards. We consider this relief mechanism to be an option of last resort. We believe this provision will protect PMMs, SVMs, and vessel operators (or marine remanufacturers) from circumstances outside their control. We, however, do not envision granting hardship relief if contract problems with a specific company prevent compliance for a second time. See the regulatory text in 40 CFR 1068.245 for additional information.

Small-volume boat builders: As proposed, we are continuing the unusual circumstances hardship provision for small-volume boat builders (those with less than 500 employees and worldwide production of fewer than 100 boats). Small-volume boat builders may apply for hardship relief if circumstances outside their control cause the failure to comply and if the failure to sell the subject vessels will have a major impact on the company's solvency. An example of an unusual circumstance outside a boat builder's control may be an ''Act of God,'' a fire at the boat building facility, or the unforeseen breakdown of a supply contract with an engine supplier. This relief allows the boat builder to use an uncertified engine and is considered a mechanism of last resort. The terms and time frame of the relief depend on the specific circumstances of the company and the situation involved. As part of its application for hardship, a company is required to provide a compliance plan detailing when and how it plans to achieve compliance with the standards. See the regulatory text in 40 CFR 1068.250 for additional information.

In addition, as described in the proposal, small-volume boat builders generally depend on engine manufacturers to supply certified engines in time to produce complying vessels by the date emission standards begin to apply. We are aware of other applications where certified engines have been available too late for equipment manufacturers to adequately accommodate changing engine size (for engines meeting Tier 4 standards, which are described in section III.B.2 of today's rule) [164] or performance characteristics. To address this concern, we are allowing small-volume boat builders to request up to one extra year before using certified engines if they are not at fault and will face serious economic hardship without an extension. See the regulatory text in 40 CFR 1068.255 for additional information.

(14) Alternate Tier 4 NO_X+HC Standards

We proposed to continue our existing emission averaging programs for the new Tier 4 NO_X and HC standards for locomotives and marine engines. However, the existing averaging programs do not allow manufacturers to show compliance with HC standards using averaging. Because we are concerned that this could potentially limit the benefits of our averaging program as a phase-in tool for manufacturers, we are establishing an alternate NO_X+HC standard of 1.4 g/bhp-hr that could be used as part of the averaging program. Manufacturers that were unable to comply with the Tier 4 HC standard would be allowed to certify to a NO_X+HC FEL, and use emission credits to show compliance with the alternate standard instead of the otherwise applicable NO_X and HC standards. For example, a manufacturer may choose to use banked emission credits to gradually phase in its Tier 4 1200 kW marine engines by producing a mix of Tier 3 and Tier 4 engines during the early part of 2014. NO_X+HC credits and NO_X credits could be averaged together without discount.

[164] Tier 3 engine-out standards are not expected to change the physical characteristics of marine engines. Tier 3 standards will not result in a larger engine or otherwise require any more space within a vessel. For Tier 4 standards, we expect that vessels will be designed to accommodate emission components that engine manufacturers specify as necessary to meet these new standards (e.g., ensure adequate space is available to package aftertreatment components).

The value of this alternate standard (1.4 g/bhp-hr) is the rounded sum of the Tier 4 NO_X and HC standards. We proposed to set this value at the level of the NO_X standard (1.3 g/bhp-hr). However, based on the comments received, we no longer believe this to be appropriate. See the Summary and Analysis of Comments for more discussion of this issue.

(15) Other Issues

We are finalizing other minor changes to the compliance program. For example, engine manufacturers will be required to provide installation instructions to vessel manufacturers and kit installers to ensure that engine cooling systems, aftertreatment exhaust emission controls, and other emission controls are properly installed. Proper installation of these systems is critical to the emission performance of the equipment. Vessel manufacturers and kit installers will be required to follow the instructions to avoid improper installation that could render emission controls inoperative. Improper installation would subject them to penalties equivalent to those for tampering with the emission controls.

We are also clarifying the general requirement that no emission controls for engines subject to this final rule may cause or contribute to an unreasonable risk to public health, welfare, or safety, especially with respect to noxious or toxic emissions that may increase as a result of emission-control technologies. The regulatory language, which addresses the same general concept as the existing §§ 92.205 and 94.205, implements sections 202(a)(4) and 206(a)(3) of the Act and clarifies that the purpose of this requirement is to prevent control technologies that would cause unreasonable risks, rather than to prevent trace emissions of any noxious compounds. This requirement prevents the use of emission-control technologies that produce pollutants for which we have not set emission standards but nevertheless pose a risk to the public. As is described in Section III and the Summary and Analysis of Comments document, this provision does not preclude the use of urea-based SCR emission controls.

Some marine engine manufacturers have expressed concern over the current provisions in our regulation for selection of an emission data engine. Part 94 specifies that a marine manufacturer must select for testing from each engine family the engine configuration which is expected to be worst-case for exhaust emission compliance on in-use engines. Some manufacturers have interpreted this to mean that they must test all the ratings within an engine family to determine which is the worst-case. Understandably, this interpretation could cause production problems for many manufacturers due to the lead time needed to test a large volume of engines. Our view is that the current provisions do not necessitate testing of all ratings within an engine family. Rather, manufacturers are allowed to base their selection on good engineering judgment, taking into consideration engine features and characteristics which, from experience, are known to produce the highest emissions. This methodology is consistent with the provisions for our on-highway and nonroad engine programs. Therefore, we are keeping essentially the same language in part 1042 as is in part 94. We are adopting similar language for locomotives and will apply it in the same manner as we do for marine engines.

B. Compliance Issues Specific to Locomotives

(1) Refurbished Locomotives

Section 213(a)(5) of the Clean Air Act directs EPA to establish emission standards for ''new locomotives and new engines used in locomotives.'' In the previous rulemaking, we defined ''new locomotive'' to mean a freshly manufactured or remanufactured locomotive.[165] We defined ''remanufacture'' of a locomotive as a process in which all of the power assemblies of a locomotive engine are replaced with freshly manufactured (containing no previously used parts) or reconditioned power assemblies. In cases where all of the power assemblies are not replaced at a single time, a locomotive is considered to be ''remanufactured'' (and therefore ''new'') if all of the power assemblies from the previously new engine had been replaced within a five year period.

Our new regulations clarify the definition of ''freshly manufactured locomotive'' when an existing locomotive is substantially refurbished including the replacement of the old engine with a freshly manufactured engine. The existing definition in § 92.12 states that freshly manufactured locomotives are locomotives that do not contain more than 25 percent (by value) previously used parts. We allowed freshly manufactured locomotives to contain up to 25 percent used parts because of the current industry practice of using various combinations of used and unused parts. This 25 percent value applies to the dollar value of the parts being used rather than the number because it more properly weights the significance of the various used and unused components. We chose 25 percent as the cutoff because setting a very low cutoff point would have allowed manufacturers to circumvent the more stringent standards for freshly manufactured locomotives by including a few used parts during the final assembly. On the other hand, setting a very high cutoff point could have required remanufacturers to meet standards applicable to freshly manufactured locomotives, but such standards may not have been feasible given the technical limitations of the existing chassis.

We are adding to § 1033.901 a definition of ''refurbish'' which will mean the act of modifying an existing locomotive such that the resulting locomotive contains less than 50 percent (by value) previously used parts (but more than 25 percent). We believe that where an existing locomotive is improved to this degree, it is appropriate to consider it separately from locomotives that are simply remanufactured in a conventional sense. As described below, we are specifying provisions for refurbished locomotives that vary by application (switch or line-haul) and model year (before or after 2015). See also section IV.B(2), which describes minimum credit proration factors for refurbished locomotives.

We are also clarifying that any locomotives built before 1973 become ''new'' and thus subject to our emission standards when refurbished. In the 1998 rulemaking, we determined that pre-1973 locomotives should not be considered ''new'' when remanufactured.[166] An important policy consideration in making that determination was our analysis of the feasibility of such locomotives to meet the Tier 0 emission standards. However, that analysis is not valid for refurbished locomotives. Given the degree to which such locomotives are redesigned and reconfigured, there is no reason that they should be considered differently from 1973 locomotives simply because their frames (or some other parts) were originally manufactured earlier.

We requested comment on setting more stringent standards for refurbished locomotives, considering that these locomotives are restored to a condition likely to allow for many years of continued service. Industry commenters expressed concern that our subjecting refurbished locomotives to more stringent standards could prove counterproductive, because state and local programs that currently help fund voluntary refurbishments to very clean emission levels could lose their incentive to continue doing so, given that these refurbishments would now just be meeting EPA standards. It was further argued that these refurbishments would also lose any opportunity to generate valuable ABT credits, given the challenge just in meeting the standards.

We believe that the need for financial incentives will be just as clear and just as strong under the new program as before. Refurbishing a locomotive effectively removes an old, high-emitting locomotive from the fleet and replaces it with a clean one. The substantial cost of doing so and the potential that, absent incentives, old locomotives (especially switchers) would continue in operation almost indefinitely are the true drivers for creating incentives, regardless of the standards involved. We expect that state and local government officials involved in this process are well aware of this and will act accordingly. The ABT credits that can be gained from these refurbishments have not been a major factor to date and, considering that the credits can subsequently be used to produce other, less clean locomotives, we do not believe that state and local governments would or should be satisfied to help finance clean locomotives that result in dirtier locomotives elsewhere. As detailed below, we are therefore adopting more stringent standards for refurbished locomotives and phasing in these standards in a way that we believe best facilitates continued refurbishment of existing locomotives, while recognizing differences between the switch and line-haul locomotive fleets and the emission reduction trends resulting from our tiered approach to standards-setting.

Currently, small numbers of old low-horsepower locomotives are being refurbished as significantly lower-emitting switch locomotives. The regulations in part 92 subject these locomotives to the Tier 0 standards (unless they contain less than 25 percent previously used parts) and allow them to generate emission credits if they are cleaner than required. The regulations in part 1033 will continue this approach through model year 2014. It is important to note that since most of these locomotives were originally

[165] As is described in this section, freshly manufactured locomotives, repowered locomotives, refurbished locomotives, and all other remanufactured locomotives are all ''new locomotives'' in both the previous and new regulations.

[166] U.S. EPA (2004) National Coastal Condition Report II. Office of Research and Development/ Office of Water. EPA–620/R–03/002. This document is available in Docket EPA–HQ–OAR–2003–0190.

manufactured before 1973, simply by meeting the Tier 0 standards they will achieve significant emission reductions.

For similar reasons, we are adopting an interim program for slightly larger locomotives with power between 2300 and 3000 horsepower refurbished through model year 2014. These locomotives, which are frequently used as road switchers, would also be subject to the Tier 0 standards for this period.

We do not believe, however, that it would be appropriate to allow switch locomotives to be refurbished to the Tier 0+ standards in the long term. Once the Tier 4 standards begin to apply, we will allow these locomotives to be certified to the Tier 3 switch locomotive standards, which will still provide the opportunity to generate some emission credits as an incentive.

The story is slightly different for higher power line-haul locomotives, which are currently not being refurbished. Nearly all of these remaining in the Class I railroad fleets were originally manufactured in or after 1973 and are already subject to the Tier 0 or later standards. Therefore there will be less of an air quality incentive to fund their refurbishment, and so we are specifying that refurbished line-haul locomotives be subject to the same standards as freshly manufactured locomotives. The regulations would treat them the same except for emission credit proration factors, which are described in section IV.B.(2)

Another important consideration is the potential for refurbishment to be used as a loophole to circumvent the freshly manufactured standards for line-haul locomotives. Railroads currently turn over their line-haul fleets much faster than their switch fleets. However, it is not hard to envision a scenario in which railroads began refurbishing their locomotives rather than buying freshly manufactured locomotives, especially as the Tier 4 standards went into effect. A long-term program requiring that refurbished line-haul locomotives meet the same standards as freshly manufactured locomotives prevents refurbishment from being used as such a loophole.

TABLE IV–2.—PROVISIONS FOR REFURBISHED SWITCH LOCOMOTIVES

	Applicable tier of standards	Minimum proration factor
Locomotives refurbished before 2015	Tier 0+	0.60
Locomotives refurbished in 2015 or later	Tier 3	0.60

TABLE IV–3.—PROVISIONS FOR REFURBISHED LINE-HAUL LOCOMOTIVES

	Applicable tier of standards	Minimum proration factor
Locomotives refurbished before 2015	Tier 2+/3	0.60
Locomotives refurbished in 2015 or later	Tier 4	0.60

(2) Averaging, Banking and Trading

For the most part, our new regulations will continue the existing averaging banking and trading provisions for locomotives. This section only highlights the provisions that are most significant in the context of this Final Rule. The reader is encouraged to read subpart H of part 1033 for details of this program.

In order to ensure that the ABT program is not used to delay the implementation of the Tier 4 technology, we are applying a restriction similar to the averaging restriction that was adopted for Tier 2 locomotives in the previous locomotive rulemaking. We are restricting the number of Tier 4 locomotives that could be certified using credits to no more than 50 percent of a manufacturer's annual production. As was true for the earlier restriction, this is intended to ensure that progress is made toward compliance with the advanced technology expected to be needed to meet the Tier 4 standards. This will encourage manufacturers to make every effort toward meeting the Tier 4 standards, while allowing some use of banked credits to provide needed lead time in implementing the Tier 4 standards by 2015, allowing them to appropriately focus research and development funds.

We proposed to allow the carryover of all Part 92 credits except for PM credits generated from Tier 0 or Tier 1 locomotives. The Tier 0 and Tier 1 PM standards under part 92 were set above the average baseline level to act as caps on PM emissions rather than technology-forcing standards. While Part 92 allows credits generated only relative the estimated average baseline rather than the standards, we were still concerned that such credits might have been windfall credits. However, as is described in the Summary and Analysis of Comments document, after further analysis we now believe that allowing the carryover of all part 92 PM credits is appropriate and will allow such credits to be used under part 1033.

We are also updating the proration factors for credits generated or used by remanufactured locomotives. The updated proration factors better reflect the difference in service time for line-haul and switch locomotives. The ABT program is based on credit calculations that assume as a default that a locomotive would remain at a single FEL for its full service life (from the point it is originally manufactured until it is scrapped). However, when we established the existing standards, we recognized that technology would continue to evolve and that locomotive owners may wish to upgrade their locomotives to cleaner technology and certify the locomotive to a lower FEL at a subsequent remanufacture. We established proration factors based on the age of the locomotive to make calculated credits for remanufactured locomotives consistent with credits for freshly manufactured locomotives in terms of lifetime emissions. These proration factors are shown in § 1033.705 of the new regulations. These replace the existing proration factors of § 92.305. For example, using the new proration factors, a 15-year-old line-haul locomotive certified to a new FEL that was 1.00 g/bhp-hr below the applicable standard would generate the same amount of credit as a freshly manufactured locomotive that was certified to an FEL that was 0.43 g/bhp-hr below the applicable standard because the proration factor would be 0.43. For comparison, under the old regulations, the proration factor would have been 0.50.

We are correcting how the proration factors apply for refurbished locomotives to more appropriately give credits to railroads for upgrading old locomotives to use clean engines, rather than to continue using the old high emission engines indefinitely. As with the rest of the program, credits will be calculated from the difference between the applicable standard and the emissions of the new refurbished locomotive, adjusted to account for the projected time the locomotive would remain in service. The correction creates a floor for the credit proration factor for refurbished locomotives of 0.60. This is equal to the proration factor for 20-year-old switchers and would also be equivalent to a proration factor for a locomotive that was just over 10 years old. For example, refurbishing a 35-year-old switch locomotive to an FEL 1.0 g/bhp-hr below the Tier 0 standard would generate the same amount of credit as a conventional remanufacture of a 20-year-old switch locomotive to an FEL 1.0 g/bhp-hr below the Tier 0 standard. This is because we believe that such refurbished switch locomotives will almost certainly operate as long as a 20-year-old locomotive that was remanufactured at the same time. Similarly, we believe that refurbished line-haul locomotives would likely operate as long as a 10-year-old locomotive that was remanufactured at the same time.

Finally, we are finalizing special provisions for credits generated and used by Tier 3 and later locomotives. Under the current part 92 ABT program, credits are segregated based on the cycle over which they are generated but not by how the locomotive is intended to be used (switch, line-haul, passenger, etc.). Line-haul locomotives can generate credits for use by switch locomotives, and vice versa, because both types of locomotives are subject to the same standards. However, for the Tier 3 and Tier 4 programs, switch and line-haul locomotives are subject to different standards with emissions generally measured only for one test cycle. We will allow credits generated by Tier 3 or later switch locomotives over the switch cycle to be used by line-haul locomotives to show compliance with line-haul cycle standards. As proposed, we are not allowing such cross-cycle use of line-haul credits (or switch credits generated by line-haul locomotives) by Tier 3 or later switch locomotives.

To make this approach work without double-counting of credits, we are also adopting a special calculation method where the credit using locomotive is subject to standards over only one duty cycle while the credit generating locomotive is subject to standards over both duty cycles (and can thus generate credits over both cycles). In such cases, we would require the use of credits under both cycles. For example, for a Tier 4 line-haul engine family needing 1.0 megagram of NO_X credits to comply with the line-haul emission standard, the manufacturer would have to use 1.0 megagram of line-haul NO_X credits and 1.0 megagram of switch NO_X credits if the line-haul credits were generated by a locomotive subject to standards over both cycles.

(3) Phase-In and Reasonable Cost Limit

The new Tier 0 and 1 emission standards become applicable on January 1, 2010. We also proposed a requirement for 2008 and 2009 when a remanufacturing system is certified to these new standards. If such a system is available before 2010 for a given locomotive model at a reasonable cost, remanufacturers of those locomotives may no longer remanufacture them to the previously applicable standards. They must instead comply with the new Tier 0 or 1 emission standards when they are remanufactured. Similarly, we are requiring them to use certified Tier 2 systems for 2008 through 2012 when a remanufacturing system is certified to the new Tier 2 standards. For the purposes of this provision, ''reasonable cost'' means that the total incremental cost to the operators of the locomotive (including initial hardware, increased fuel consumption, and increased maintenance costs) during the useful life of the locomotive must be less than $250,000. This cost limit is based on the upper cost we think likely to be required to meet these standards and reflects comments on our NPRM from remanufacturers.

As part of this phase-in requirement, we are requiring certifiers to notify customers that they are applying for certificate such that their locomotives will become subject to the new standards. We would then allow owners/operators a minimum 90-day grace period (after we issue the certificate) in which they could remanufacture their locomotives to the previously applicable standards once they are notified by the certificate holder that such systems are available. This allows them to use up inventory of older parts. However, where the certifiers do not immediately notify them, railroads would be allowed a grace period of at least 120 days after they are notified. This combined approach allows sufficient time to find out about the availability of kits and to make appropriate plans for compliance. We are also adding a new provision for owners/operators that limits the total number of locomotives that would need to meet the new standards during 2008 and 2009 to a fraction of the total number of remanufactures they do between October 3, 2008 and December 31, 2009 that are subject to either the old or new standards.

We are adding provisions that would allow Tier 0/1 remanufacturers to use during the phase-in period an assigned deterioration factor of 0.03 g/bhp-hr for PM and assume that all other deterioration factors are zero. We will also apply an in-use PM add-on of 0.03 g/bhp-hr. These two provisions are intended to address lead time concerns raised by commenters. The commenters correctly point out that the available lead time is not sufficient to allow remanufacturers to verify durability of the emission controls in a more conventional way. By addressing this lead time issue, we will make it more likely that the low emission kits will be brought to market early.

(4) Recertification Without Testing

Once manufacturers have certified an engine family, we have historically allowed them to obtain certificates for subsequent model years using the same test data if the engines remain unchanged from the previous model year. We refer to this type of certification as ''carryover.'' We are also extending this allowance to owner/operators. Specifically, we are adding the following paragraph to the end of § 1033.240:

(c) An owner/operator remanufacturing its locomotive to be identical to the previously certified configuration may certify by design without new emission test data. To do this, submit the application for certification described in § 1033.205, but instead of including test data, include a description of how you will ensure that your locomotives will be identical in all material respects to their previously certified condition. You have all of the liabilities and responsibilities of the certificate holder for locomotives you certify under this paragraph.

(5) Railroad Testing

Section 92.1003 requires Class I freight railroads to annually test a small sample of their locomotives. We proposed to adopt the same requirements in § 1033.810, but asked for comments on whether this program should be changed. In particular, we requested suggestions to better specify how a railroad selects which locomotives to test, which has been a source of some confusion in recent years. In this final rule, we are adopting a revised approach that should reduce this confusion. The regulations provide four options for railroads to select locomotives for testing and require EPA to notify the railroad by January 1st for any year in which we choose to specify which locomotives should be tested.

In addition, the maximum annual testing rate is being lowered to 0.075 percent, from the previously applicable rates of 0.15 to 0.10 percent. This new rate will require Class I railroads to test approximately 20 locomotives per year. We believe that this number of tests (in addition to the testing required for certificate holders) will be enough to allow us to appropriately monitor the emission performance of in-use locomotives.

(6) Test Conditions and Corrections

In our previous rule, we established test conditions that are representative of in-use conditions. Specifically, we required that locomotives comply with emission standards when tested at temperatures from 45°F to 105°F and at both sea level and altitude conditions up to about 4,000 feet above sea level. One of the reasons we established such a broad range was to allow outdoor testing of locomotives. While we only required that locomotives comply with emission standards when tested at altitudes up to 4,000 feet for purposes of certification and in-use liability, we also required manufacturers to submit evidence with their certification applications, in the form of an engineering analysis, that shows that their locomotives were designed to comply with emission standards at altitudes up to 7,000 feet. We included correction factors that are used to account for the effects of ambient temperature and humidity on NO_X emission rates.

We are now changing how the regulations deal with the test temperatures. We are specifying that testing without correction may be performed down to a lower limit of 60°F. In implementing the prior regulations, we found that the broad temperature range with correction, which was established to make testing more practical, was problematic. Given the uncertainty with the existing correction, manufacturers have generally tried to test in the narrower range being adopted today. However, we will still allow manufacturers to test at lower temperatures but will require them to develop correction factors specific to their locomotive designs.

We are also changing the altitude requirements for switch locomotives in response to a comment noting that switch locomotives will rarely operate above 5,500 feet. For switch locomotives, we will only require manufacturers to show that their locomotives comply with emission standards at altitudes up to 5,500 feet.

(7) Duty Cycles and Calculations

(a) Idle Weighting Adjustments

While we did not propose any changes to the weighting factors for the locomotive duty cycles, we did request comment on whether such changes would be appropriate in light of the proposed idle reduction requirements. The regulations specify an alternate calculation for locomotive equipped with idle shutdown features. This provision allows a manufacturer to appropriately account for the inclusion of idle reduction features as part of its emission control system. There are three primary reasons why we are not changing the calculation procedures with respect to the idle requirements. First, different shutdown systems will achieve different levels of idle reduction in use. Thus, no single adjustment to the cycle would appropriately reflect the range of reductions that will be achieved. Second, the existing calculation provides an incentive for manufacturers to design shutdown systems that achieve in the greatest degree of idle reduction that is practical. Finally, our feasibility analysis is based in part on the emission reductions achievable relative to the existing standards. Since some manufacturers already rely on the calculated emission reductions from shutdown features incorporated into many of their locomotive designs, our feasibility is based in part on allowing such calculations.

We are adopting a slight change to the way this adjustment works as compared to the previous regulations. We are specifying that idle emission rates for locomotives meeting our minimum shutdown requirements in § 1033.115 be reduced by 25 percent, unless the manufacturer demonstrates that greater idle reduction will be achieved.

(b) Representative Cycles

We also recognize that the potential exists for locomotives to include additional power notches, or even continuously variable throttles, and that the standard FTP sequence for such locomotives would result in an emissions measurement that does not accurately reflect their in-use emissions performance. Moreover, some locomotives may not have all of the specified notches, making it impossible to test them over the full test. Under the previous regulations, we handled such locomotives under our discretion to allow alternate calculations (40 CFR 92.132(e)). We are now adopting more specific provisions in § 1033.520. In general, for locomotives missing notches, we believe the existing duty cycle weighting factors should be reweighted without the missing notches. For locomotives without notches or more than 8 power notches, the regulations reference following information provided to us by manufacturers for the previous rulemaking that shows typical notch power levels expressed as a percentage of the rated power of the engine.

In response to comments we are also adding provisions to address locomotives that include new design features that will result in changes to the in-use duty cycle. Specifically, the regulations state that manufacturers must notify us if they are adding design features that will make the expected average in-use duty cycle of their engine family significantly different from the otherwise applicable test cycle. They must also recommend an alternate test cycle that represents the expected average in-use duty cycle. We will specify whether to use the default duty cycle, the recommended cycle, or a different cycle, depending on which cycle we believe best represents expected in-use operation. For locomotives subject to both line-haul and switch cycle standards, the regulations specify that a single set of standards would apply for the representative cycle.

(c) Energy Saving Design Features

We are adopting special provisions for locomotives equipped with energy-saving design features, such as sophisticated electronic optimization of throttle and brake settings based on route data or locomotive operation in a consist, electronically controlled pneumatic (ECP) brakes, and hybrid technology. The provisions we are adopting recognize that to whatever degree the total work done by a locomotive is reduced, the mass emissions would likely also be reduced. For example, if certain design features reduced by three percent the amount of work needed to pull a typical train, then the mass emission rate (g/hr) would generally also be reduced by three percent. Under the new provisions, manufacturers will be allowed to adjust their locomotives' emissions to reflect this, based on data gathered prior to certification.

Manufacturers choosing to adjust emissions under these provisions must present a test plan to EPA for approval prior generating the in-use data necessary to estimate their emissions reductions. The degree to which manufacturers would be allowed to take a credit at certification would be determined from a statistical analysis of their supporting data to address the uncertainty in their estimate. This would minimize the possibility that manufacturers would be given credit for emission reductions that did not actually occur. Later, additional data on the in-use fleet using the feature could be gathered to improve the statistical certainty and this could then be factored into subsequent certifications. In concept, however, if we had perfect data, we would grant the manufacturers full credit for the savings.

Since our standards are specified as brake-specific emission limits, no credit or adjustment will be allowed for features that only improve the engine's brake-specific fuel consumption. The nature of the test procedure itself already properly credits such features. Thus, allowing additional credits to be calculated would be double-counting of credits.

(8) Non-OEM Remanufacturing Parts

We are adopting measures in § 1033.645 to help provide for the continued participation in remanufacturing by parts manufacturers willing to take responsibility for the long-term emissions performance of their parts but who lack the wherewithal to design and certify entire locomotive remanufacture systems that may include complex emissions control systems far beyond their expertise. Under this program, we would determine, based on an upfront engineering analysis, that the part supplier has a reasonable basis for concluding that use of their part would be equivalent to the OEM part in use. We would later verify its emission performance through in-use emission testing.

The exact nature of the engineering analysis necessary to demonstrate that the part supplier has a reasonable basis for concluding that use of their part (or parts) will not cause emissions to increase beyond the level expected from the OEM part in use, is expected to vary. We see four possible paths to accomplish this.

- The part is shown to be identical to the original part in all material respects.
- The part differs physically from the original in a small number of ways and each of these is evaluated to show that the aftermarket part will be as good as or better than the original with respect to emissions performance.
- Measurable emission-critical parameters such as fuel injection profile or engine oil consumption rate are established and an engine (or relevant engine subsystem) using the aftermarket part is shown through testing to perform as good or better than one with the original part with respect to these parameters.
- Emissions testing and durability demonstration is performed in essentially the same manner as for remanufactured system certification.

For example, cylinder liners differing only in color and part number from the OEM liners would be identical in all material respects. Those having different bore groove patterns would not be considered identical, but an analysis of the difference this makes in the oil's interaction with the cylinder wall and rings (which could have an impact on PM emissions) could suffice to make the demonstration. Chrome-plated cylinder liners in combination with a specified piston ring set used in place of original rings and non-plated liners could be expected to affect the emission-critical parameter of oil consumption, especially later in the locomotive useful life due to differences in wear rates. Bench or field testing over time demonstrating lower oil consumption trends than original equipment could provide a sufficient demonstration, provided no other emission-critical parameters are involved. We do not believe it is necessary or even possible to specify in the regulations the appropriate emission-critical parameters for all of the locomotive aftermarket components identified in this provision or to specify the test procedures and criteria by which these parameters are evaluated. Instead, we are establishing broad criteria and requiring the part suppliers to propose the appropriate emission-critical parameters and corresponding test or analytical methods appropriate to the part they produce.

We would allow railroads to use the non-OEM part during remanufacturing once we have approved the supplier's engineering analysis. Once the part has been installed in at least 250 locomotives, we would require one of them to be tested. One additional locomotive would need to be tested from the next additional 500 locomotives that use the part. If any locomotives fail to meet all standards, we generally require one additional locomotive to be tested for each locomotive that fails. We would generally allow the supplier to include testing performed by others. For example, if a railroad tests a locomotive with the part under § 1033.810, the supplier could submit those test data as fulfillment of its test obligations.

We are adopting these provisions to address the specific issue of parts that are typically replaced during remanufacturing and for which there is an active aftermarket. Therefore, we are only specifying cylinder liners, cylinder heads, pistons, rings, and fuel injectors as being covered by this program. We reserve the authority to expand the program to cover other parts.

(9) Use of Nonroad Engines Certified Under 40 CFR Parts 89 and 1039

Section 92.907 currently allows the use of a limited number of nonroad engines in locomotive applications without certification under the locomotive program. We believe a similar allowance should also be included in the new regulations. However, we are making some changes to these procedures. In general, manufacturers have not taken advantage of these previously existing provisions. In some cases, this was because the manufacturer wanted to produce more locomotives than allowed under the exemption. However, in most cases, it was because the customer wanted a full locomotive certification with the longer useful life and additional compliance assurances. We are adopting new separate approaches for the long term (§ 1033.625) and the short term (§ 1033.150), each of which addresses at least one of these issues.

For the long term, we are replacing the existing allowance that relies on part 89 certificates with a design-certification program that makes the locomotives subject to the locomotive standards in use but does not require new testing to demonstrate compliance at certification. Specifically, this program allows switch locomotive manufacturers using nonroad engines to introduce up to 30 locomotives of a new model prior to completing the traditional certification requirements. While the manufacturer would be able to certify without new testing, the locomotives would have locomotive certificates. Thus, purchasers would have the compliance assurances they desire.

As is described in section III B (1)(b), the short-term program is more flexible and does not require that the locomotives comply with the switch cycle standards; instead the engines would be subject to the part 1039 standards. The manufacturers would be required to use good engineering judgment to ensure that the engines' emission controls would function properly when installed in the locomotives. For example, the locomotive manufacturer would need to ensure that sufficient cooling capacity was available to cool the engine intake air. Given the relative levels of the part 1039 standards and those being proposed in 1033, we do believe there is little environmental risk with this short-term allowance and thus are not including any limits of the sales of such locomotives. Nevertheless, we are limiting this allowance to model years through 2017. This provides sufficient time to develop these new switchers. These locomotives would not be exempt from the part 1033 locomotive standards when remanufactured, unless the remanufacturing of the locomotive took place prior to 2018 and involved replacement of the engines with certified new nonroad engines. Otherwise, the remanufactured locomotive will be required to be covered by a part 1033 remanufacturing certificate.

(10) Mexican and Canadian Locomotives

Under the prior regulations, Mexican and Canadian locomotives are subject to the same requirements as U.S. locomotives if they operate extensively within the U.S. The regulation 40 CFR 92.804(e) states:

Locomotives that are operated primarily outside of the United States, and that enter the United States temporarily from Canada or Mexico are exempt from the requirements and prohibitions of this part without application, provided that the operation within the United States is not extensive and is incidental to their primary operation.

We are changing this exemption to make it subject to our prior approval, since we have found that the current language has caused some confusion. When we created this exemption, it was our understanding that Mexican and Canadian locomotives rarely operated in the U.S. and the operation that did occur was limited to within a short distance of the border. We are now aware that there are many Canadian locomotives that do operate extensively within the U.S. and relatively few that meet the conditions of the exemption. We have also learned that some Mexican locomotives may be operating more extensively in the United States. Thus, it is appropriate to make this exemption subject to our prior approval. To obtain this exemption, a railroad will be required to submit a detailed plan for our review prior to using uncertified locomotives in the U.S. We will grant an exemption for locomotives that we determine will not be used extensively in the U.S. and that such operation will be incidental to their primary operation. Mexican and Canadian locomotives that do not have such an exemption and do not otherwise meet EPA regulations may not enter the United States.

(11) Other Locomotive Issues

The regulations in part 92 allow locomotive owners to voluntarily subject their pre-1973 locomotives to the Tier 0 standards or to include in the locomotive program low-horsepower locomotives that would otherwise be excluded based on their rated power. We are also including these options in the new part 1033. We will also provide two additional options. First, we will allow Tier 0 switch locomotives, which are normally not subject to line-haul cycle standards, to be voluntarily certified to the line-haul cycle standards. Second, we will allow any locomotives to be voluntarily certified to a more stringent tier of standards. An example of where these options may be desirable would be a case in which a customer wants to purchase a refurbished switch locomotive that meets the Tier 2 standards. While it may seem obvious that it would be allowed, the old regulations are unclear. The part 1033 regulations eliminate this confusion.

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 emission-related repairs. This was not our intent. Rather, the maintenance provision was intended to merely require that the maintenance be performed in a timely manner. For many repairs, it may be appropriate to wait until the next 92-day inspection. However, for many others it would be appropriate to make the repair sooner to the extent practical.

In response to comments, we are adding an interim allowance to simplify certification testing of locomotive engines. Specifically, for model years before 2014, we will allow manufacturers to test locomotive engines for certification without replicating the transient behavior in the locomotive. This will make it easier for manufacturers to certify new cleaner remanufacturing systems for the full range of locomotive models.

C. Compliance Issues Specific to Marine Engines

(1) Remanufacturing

As discussed in Section III, above, we are adopting a marine remanufacture program for marine diesel engines over 600 kW built from 1973 through Tier 2 that requires the use of a certified remanufacture system when such an engine is remanufactured, if one is available. Certified remanufacture systems must achieve at least a 25 percent reduction in PM emissions. This section briefly describes several certification and compliance provisions for the marine remanufacture program; the full program is contained in the regulations for this rule.

In general, the normal certification requirements for new marine diesel engines would apply, with minor variations as needed to accommodate the characteristics of remanufactured engines. For example, engine families are based on the same criteria as for freshly manufactured engines, and testing, reporting, the application for certification, and warranty requirements closely follow the provisions that apply for freshly manufactured engines.

In general, remanufactured engines are considered to be ''new'' engines, and they remain new until sold or placed back into service after the replacement of the last cylinder liner. The standards do not apply for engines that are rebuilt without removing cylinder liners. For a new engine to be placed into service, it must be covered by a certificate of conformity.

As is the case with our other emission control programs, certification testing for conformity demonstration will be performed on the most common configuration within an engine family. An engine family is a group of engines that have the same characteristics with respect to combustion cycle and fuel, cooling system, method of air aspiration, method of exhaust aftertreatment, combustion chamber design, bore and stroke, and mechanical or electronic controls. Other configurations may be included if it can be shown based on good engineering judgment that they are likely to provide a PM reduction similar to the configuration tested. Compliance for these other configurations is based on an engineering demonstration that the remanufacturing system reduces PM emissions by 25 percent without increasing NO_X emissions. Engine families may also include remanufacturing systems corresponding to engines that were originally produced over multiple model years, as long as the configuration does not change in a way that affects the validity of certification for the remanufacturing system.

To certify a remanufacture system, a manufacturer must measure baseline emissions and emissions from an engine remanufactured using its system. A baseline emission rate would be established by remanufacturing an engine following normal procedures. That engine or a second engine of the same configuration is then tested for emissions after remanufacturing with the expected emission controls. The remanufacturing system meets the emission standards of the program by demonstrating a minimum 25 percent reduction in PM emissions and no increase in NO_X emissions (within 5 percent). The remanufacturer must also demonstrate that the remanufacturing system does not adversely affect engine reliability or power.

The remanufacturer must also demonstrate that the total marginal cost of the remanufacturing system is less than $45,000 per ton of PM reduction. For the purpose of this demonstration, marginal cost means the difference in costs between remanufacturing the engine using the remanufacture system and remanufacturing the engine conventionally. Total marginal costs over the period of one useful life are divided by the projected PM emissions over one useful life to obtain the cost of the remanufacture system per ton of PM reduced. Costs to be considered include hardware costs, labor costs, operating costs over one useful life period, and other costs (such as shipping).

The useful life provisions established for freshly manufactured engines would apply equally to remanufactured engines. In general, remanufacturers would be responsible for meeting emission standards for 10 years or 10,000 hours of operation for Category 1 engines, and 10 years or 20,000 hours of operation for Category 2 engines.

Certification will rely on a deterioration factor, similar to freshly manufactured engines. The certifying company may either use an assigned value of 0.015 g/kW-hr for PM or develop a new deterioration factor based on engine testing. For Tier 2 engines, the certifying company needs to add the deterioration factor to measured emission levels for certification. The deteriorated number must be less than the applicable PM standard. For Tier 1 and earlier engines, the deterioration factor is added to the emission level established for the certified configuration and that higher emission level serves as the emission standard for any in-use testing after certification.

The regulations allow for simplified certification requirements for remanufacture systems that are already certified under the locomotive program. This would require only an engineering analysis demonstrating that the system would achieve emission reductions from marine engines similar to those from locomotives. Because the marine remanufacture program requires only a PM reduction, locomotive remanufacture system manufacturers may modify those locomotive systems with respect to NO_X emissions. In that case, the system will have to be recertified as a marine remanufacture system based on measured values and subject to all of the other certification requirements of the marine remanufacture program.

Remanufactured engines are not eligible for generating or using emission credits for averaging, banking, or trading. This is appropriate because the program we are finalizing is only mandatory if a system has been certified for the relevant engine. We will reconsider allowing systems to be based on emission credits when we consider whether to adopt a mandatory marine remanufacture program (Part 2 of the proposed program) at a later date.

Not-to-exceed standards do not apply to remanufacturing. This is appropriate because the base engine in most cases is not subject to NTE requirements. In addition, NTE is most appropriately considered in the initial engine design phase; requiring remanufactured engines to meet the NTE requirements would likely require more intensive engine redesign than is anticipated by the simpler program we are finalizing.

Finally, other provisions such as those governing maintenance intervals, warranties, duty cycles, test fuel, labeling, recordkeeping, etc. are the same as or similar to those for freshly manufactured engines.

(2) Replacement Engines

We are revising certain aspects of our existing provisions with regard to replacement engines, as described below. These requirements apply to all marine diesel engines, propulsion or auxiliary, regardless of marine application. Section 1042.601(c) provisions apply instead of the provision of section 1068.240(b)(3) that applies for other nonroad engines.

(a) Replacement With a Freshly Manufactured Engine

Under the current marine diesel engine program, an engine manufacturer is generally prohibited from selling a marine engine that does not meet the standards that are in effect when that engine is produced. However, we recognize that there may be situations in which a vessel owner may require an engine certified to an earlier tier of standards. The two most likely situations are (1) when a vessel has been designed to use a particular engine such that it cannot physically accommodate a different engine due to size or weight constraints (e.g., a new engine model will not fit into the existing engine compartment); or (2) when the engine is matched to key vessel components such as the propeller, or when a vessel has a pair of engines that must be matched for the vessel to function properly.

To address these extreme situations, we amended existing regulation 40 CFR 94.1103(b)(3) to allow a manufacturer to produce a new engine which meets an earlier tier of standards if the Administrator determined that no new engine certified to the emission limits in effect at that time is produced by any manufacturer with the appropriate physical or performance characteristics needed to repower the vessel. An engine manufactured pursuant to this provision is subject to certain conditions: The replacement engine must meet standards at least as stringent as those of the original engine; the engine manufacturer must take possession of the original engine or confirm it is destroyed; and the replacement engine must be clearly labeled to show that it does not comply with the standards and that sale or installation of the engine for any purpose other than as a replacement engine is a violation of federal law and subject to civil penalty.

We subsequently revised this provision to allow the engine manufacturer to make the determination of whether an engine compliant with the current standards would fit a vessel, but solely in cases of catastrophic failure (see 70 CFR 40419, July 13, 2005). This change was made to reflect industry concerns that obtaining prior EPA approval would take too long. The engine manufacturer may make the determination in catastrophic failure situations provided that the following conditions are met: The manufacturer must determine that no certified engine is available, either from its own product lineup or that of the manufacturer of the original engine (if different); and the engine manufacturer must document the reasons why an engine of a newer tier is not usable, and this report must be made available to us upon request. We also specified in § 94.1103(a)(8) that no other significant modifications to the vessel can be made as part of the process of replacing the engine, or for a period of 6 months thereafter.

In response to comments on the proposal for this rulemaking, we are finalizing three additional revisions to the replacement engine provisions. 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. This is a significant change to the program. Engine manufacturers and user groups were concerned about the amount of time that would be needed to obtain prior EPA approval, even in these noncatastrophic cases. Even though the noncatastrophic engine replacement is more typically planned in advance, it is still the case that the determination must be made in a timely manner to ensure the engine manufacturer has time to produce the engine before the vessel is taken out of service for the replacement. Therefore, we are revising the program to allow the engine manufacturer to make such determinations, 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 freshly manufactured 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 freshly manufactured engine when a vessel is refurbished such that it becomes a new vessel.

The second change to the replacement engine provision is necessary to accommodate the new tiers of standards we are adopting in this rulemaking. Specifically, in making the feasibility determination the engine manufacturer is now required to consider all previous tiers and use any of their own engine models from the most recent tier that meets the vessel's physical and performance requirements. If an engine manufacturer can produce an engine that meets a previous tier of standards representing better control of emissions than that of the engine being replaced, the manufacturer would need to supply the engine meeting the tier of standards with the lowest emission levels. For example, if a Tier 1 engine is being replaced after the Tier 3 standards go into effect, the engine manufacturer would have to demonstrate why a Tier 2 as well as a Tier 3 engine cannot be used before a Tier 0 engine can be produced and installed. Similarly, for an engine built prior to 2004, the engine manufacturer would have to demonstrate why a Tier 1, Tier 2, or a Tier 3 engine cannot be used. It should be noted, in the case of Tier 0 engines, that MARPOL Annex VI prohibits replacing an existing engine at or above 130 kW with a freshly manufactured engine unless it meets the Tier 1 standards.

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 NO_X 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.

(b) Replacement With an Existing Engine

Our current marine diesel engine program does not contain provisions that address the case in which an engine is replaced with an existing used engine. This means that if a vessel owner replaces an existing engine with a used engine, then that replacement engine is not required to be certified to our marine standards. It should be noted, however, that engines greater than 600 kW that are built after 1973 would still be subject to the remanufacture program described in Section III(C)(2)(b). This means if the existing engine that is the replacement engine has all of its cylinder liners replaced, it will be required to be remanufactured using a certified remanufacture system if one is available for that engine. It is our expectation that a vessel owner would not replace an existing engine above 600 kW with a partially-rebuilt engine, and therefore we do not expect to see replacement engines that are not remanufactured if there is a certified remanufacture system available.

These remanufacture requirements would apply whether the owner is obtaining an identical existing (used) replacement engine due to an engine failure or through an engine exchange for a periodic engine rebuild. These requirements would also apply if a vessel owner is obtaining a different model existing (used) replacement engine, for whatever reason.

It should be noted that pursuant to the definition of ''new marine engine,'' used engines brought into the marine market from other segments (e.g., locomotive, land-based nonroad, or highway sectors) are considered to be new marine diesel engines when they are marinized or modified for use on a vessel, and must meet the standards for newly manufactured engines in effect when such an engine is marinized or modified for installation on a vessel.

(c) Swing Engines

A swing engine is an additional engine that is purchased at the time the vessel is constructed as part of a rebuild strategy. When an engine is due for rebuild, that engine is removed from the vessel and replaced with the swing engine. The removed engine is rebuilt and then becomes the swing engine. Note that a swing engine is not meant to be a replacement engine in case of engine failure. Rather, it is a maintenance practice.

It is our expectation that the swing engine would undergo a complete rebuild, including cylinder liner replacement, before it is made available as the swing engine. That would constitute remanufacturing, and the engine would be required to comply with the engine remanufacture requirements. In general, this means that all engines that are part of a swing engine rebuild practice are expected to comply with the remanufacture requirements over time, providing a certified remanufacture system is available.

(d) Vessel Refurbishing

Our current program specifies that in addition to newly manufactured vessels, a vessel is considered to be ''new'' if it is modified such that the value of the modifications exceeds 50 percent of the value of the modified vessel. Such a refurbished vessel would be required to have an engine that is compliant with the standards in place when the vessel is modified. We expect that most vessel modifications will not trigger this threshold, but the requirement is necessary to accommodate those cases where a major structural change is done to a vessel that make it like-new.

We are revising this provision to specify how temporary modifications will be treated under this provision. In general, temporary modifications to a vessel 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) Personal Use Exemption

The current marine diesel engine emission control program contains certain exemptions from the standards, including the following: test engines; manufacturer-owned engines; display engines; competition engines; export engines; and certain military engines. We also provide an engine dresser exemption that applies to marine diesel engines that are produced by marinizing a certified highway, nonroad, or locomotive engine without changing it in any way that may affect the emissions characteristics of the engine.

In addition to these existing exemptions we are also adding a new provision that exempts an engine installed on a vessel manufactured by a person for his or her own use (see 40 CFR 1042.630). This is intended to address the hobbyists and fishermen who make their own vessel (from a personal design, for example, or to replicate a vintage vessel) and who would otherwise be considered to be a manufacturer subject to the full set of emission standards by introducing a vessel into commerce. The exemption is intended to allow such a person to install a rebuilt engine, an engine that was used in another vessel owned by the person building the new vessel, or a reconditioned vintage engine (to add greater authenticity to a vintage vessel). The exemption is not intended to allow such a person to order a new uncontrolled engine from an engine manufacturer. We expect this exemption to involve a very small number of vessels, so the environmental impact of this exemption will be negligible, while the cost would otherwise be high to install a certified compliant engine.

Because the exemption is intended for hobbyists and fishermen, we are setting additional constraints. First, the vessel may not be used for general commercial purposes. The one exception to this is that the exemption allows a fisherman to use the vessel for his or her own commercial fishing. Second, the exemption is limited to one such vessel over a ten-year period and does not allow exempt engines to be sold for at least five years. We believe these restrictions are not unreasonable for a true hobby builder or comparable fisherman. Moreover, we require that the vessel generally be built from unassembled components, rather than simply completing assembly of a vessel that is otherwise similar to one that must use a freshly manufactured engine certified to meet the applicable emission standards. The person also must be building the vessel him- or herself, and not simply ordering parts for someone else to assemble. Finally, the vessel must be a vessel that is not classed or subject to Coast Guard inspections or surveys.

(4) Lifeboat/Rescue Boat Exemption

Our current marine diesel engine program does not exempt lifeboats or rescue boats, and we did not propose to revise that approach. This approach was developed for the Tier 2 marine diesel engine standards. As we explained in our 1999 FRM, the technologies that would meet Tier 2 standards would not have inherent negative effect on the performance or power density of an engine, and we expected that manufacturers would be able to use the range of technologies available to maintain or even improve the performance capabilities and reliability of their engines. We also note that land-based emergency engines such as standby generators are not exempt from our emission control requirements in either highway or nonroad applications.

We received several comments from manufacturers of lifeboats and rescue boats requesting that we reconsider this approach and exempt engines on lifeboats and rescue boats from the Tier 3 and Tier 4 standards. They noted that engines on lifeboats and rescue boats are not regularly used as they are intended for use only during emergencies, and they are generally only operated for 3 minutes once a week and are water tested for a short period only a few times a year. Boat manufacturers were also concerned about the reliability of electronic controls and advanced technology aftertreatment systems in these situations, especially when the boats are stored on deck and exposed to the elements.

We've also learned that at least some engine manufacturers that have certified engines in the past for use on Coast Guard approved lifeboats and rescue boats pursuant to Coast Guard and international (International Convention for the Safety of Life at Sea—SOLAS) requirements have not yet done so for Tier 2 engines and may elect not to do so at all.[167] The Coast Guard and SOLAS certification requirements are meant to ensure that an engine will perform after it is inverted, will operate when submerged up to the crankshaft, and will readily start at temperatures as low as −15 degrees C. This certification is expensive and time-consuming, and those costs may be difficult to recover over the limited U.S. market for lifeboats and rescue boats (100 to 150 boats per year). Manufacturers of those lifeboats that use those engines must either find an alternative engine for their product, and recertify the boats to the Coast Guard and SOLAS requirements, or exit the market.

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 times 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 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 freshly manufactured 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 U.S. Coast Guard under approval series 160.135 or 160.156. Using such a vessel as 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

[167] See *http://www.uscg.mil/hq/g-m/mse4/boatlb.htm#LIFEBOAT_FOR_MERCHANT_VESSELS* for/Coast/Guard requirements for lifeboats and rescue boats.

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 U.S. Coast Guard under approval series 160.135 (except those which are also approved for use as launches or tenders) and rescue boats approved by the U.S Coast Guard under series 160.156.

(5) Stand-By Emergency Auxiliary Engines

We are exempting certain stand-by emergency auxiliary engines from the Tier 4 standards. This exemption is necessary due to the fact that these engines are rarely used, their operation being limited to periodic testing of several minutes duration. 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; 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 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.

(6) Gas Turbine Engines

While gas turbine engines[168] are used extensively in naval ships, they are not used very often in commercial ships. Because of this and because we do not currently have sufficient information, we are not including marine gas turbines in this rulemaking. Nevertheless, we believe that gas turbines could likely meet the new standards (or similar standards) since they generally have lower emissions than diesel engines and may reconsider gas turbines in a future rulemaking.

(7) Natural Gas Engines

The increasing deployment of tankers carrying liquefied natural gas has led to greater numbers of large marine engines running on natural gas instead of diesel fuel. Depending on the technological approach engine manufacturers take, these engines could fall under our definition for spark-ignition engines even though their design and development is more like compression-ignition engines. Without some clarifying provision, these engines would therefore be subject to the standards that we are developing for inboard spark-ignition engines, which are based on automotive technologies. Since this is clearly not appropriate, we are adopting a provision to specify that natural gas engines above 250 kW are subject to standards for marine compression-ignition engines regardless of our regulatory definitions for spark-ignition and compression-ignition engines. Since the analysis of control technology and the estimated costs and emission reductions are very similar to that for diesel-fueled engines, we have made no effort to separately analyze these engines relative to the new emission standards.

(8) Residual Fuel Engines

The vast majority of Category 1 and 2 marine diesel engines subject to EPA's emission standards operate on distillate diesel fuel. There are cases, however, in which the owner of a vessel may prefer to operate a Category 2 engine on another type of diesel fuel. This is mainly the case for auxiliary engines on ocean-going vessels, to allow them to use the same fuel that is used in the propulsion engine (typically residual fuel). There are also a few vessels operated on the Great Lakes that use residual fuel or residual fuel blends.

Our marine diesel engine program requires engine manufacturers to perform certification testing using the same type of fuel that will be used in actual engine operation. This requirement, which was also included in our 1999 Tier 2 rule, is intended to ensure that engines meet the emission limits in operation. In our proposal, we noted that engine manufacturers have not certified Category 1 or 2 engines that can be operated on residual fuel to the Tier 2 standards. Manufacturers explained that it is not profitable to do so due to the small size of the U.S. market for these engines. They also informed us that it would be difficult to meet EPA's PM standards on residual fuel.

Some owners expressed concern to EPA about the unavailability of large auxiliary engines certified to the Tier 2 standards on residual fuel. These owners expressed a preference for auxiliary engines run on the same fuel as propulsion engines to simplify ship operations. To respond to this concern, we asked for comment on a compliance consisting of an alternative PM standard and a tighter NO_X 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.

The alternative of exempting residual fuel engines from the test fuel requirement and allowing them to be tested on distillate fuel is not appropriate. All of our mobile source emission control programs are predicated on an engine meeting the emission standards in use. The test fuel requirement is one of several provisions that help ensure in-use compliance, including useful life periods, emission deterioration factors, durability testing, and not-to-exceed zone. Amending the test fuel provisions to allow manufacturers to certify residual fuel engines using distillate fuel would introduce considerable uncertainty into the in-use performance of these engines,

[168] Gas turbine engines are internal combustion engines that can operate using diesel fuel, but do not operate on a compression-ignition or other reciprocating engine cycle. Power is extracted from the combustion gas using a rotating turbine rather than reciprocating pistons.

would weaken the emission standards, and would be contrary to the goals of our program.

We received no comments supporting the compliance flexibility described above, and therefore 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. We expect to revisit this issue in the context of our upcoming rulemaking for Category 3 marine diesel engines.

(9) Duty Cycles for Marine Engines

Manufacturers pointed out two inconsistencies between the proposal and existing requirements for marine engines related to the proposed duty cycles for marine propulsion engines less than 37 kW and the proposed duty cycle for propeller-law auxiliary engines. We agree that the existing 4-mode duty cycle (E3) should be used for these applications and have corrected this in the final rule.

We received comment that the 8-mode (C1) duty cycle was not designed to represent variable-speed propulsion engines intended for use with variable-pitch or electrically-coupled propellers. Caterpillar provided an example of a power curve for a variable-speed engine designed to operate with a controllable pitch propeller where the operation is limited at low and mid-range speeds. In this case, we agree that the constant speed (E2) test duty cycle, combined with the NTE requirements, is more representative of the operation of this engine than the proposed C1 cycle. For this engine, the power and torque at the C1 intermediate speed is relatively low, leading to a heavy weighting of low power operation. In addition, the power limit curve, for overload protection, is at lower power than even the E3 duty cycle.

Controllable pitch propellers are also used with variable speed engines that have power curves that are more similar to those seen for nonroad engines or marine engines used with fixed pitch propellers. We are concerned that the E2 duty cycle would not be representative of the operation of these engines. Therefore, we are finalizing the E3 duty cycle for variable-speed propulsion engines intended for use with variable-pitch or electrically-coupled propellers. In the case where the engine is not capable of operating over the E3 duty cycle in-use, the E2 duty cycle would be used. For the purposes of this requirement, we consider an engine capable of operating over the E3 duty cycle if the engine can safely achieve more than 1.15 times the power specified in the E3 duty cycle at 63, 80, and 91 percent of maximum test speed.

(10) Definition of Recreational Marine Diesel Vessel

We are adopting a revised the definition of recreational marine diesel vessel in part 1042 that will essentially return to the definition we originally adopted in 1999. This revision will effectively rescind that change we made in our 2003 recreational engine rule (68 FR 9745, February 28, 2003). As is described later, in that rulemaking we revised the definition of recreational vessel by adding a reference to the Coast Guard definition in 46 U.S.C. 2101. However, since then, it has become clear that the revision resulted in significant confusion for industry.

As described above, the Tier 3 standards that apply to recreational marine diesel engines are different than those that apply to standard power density commercial engines and recreational engines are not subject to the Tier 4 standards. Recreational engines are also subject to different compliance requirements, notably the duty cycle for certification testing and their useful life. These programmatic differences reflect the different way in which these engines are used, with recreational engines generally having a higher power/density ratio, operating at a higher load, and being used for fewer hours over their life than commercial engines.

Recreational engines are defined based on whether or not they are intended by the engine manufacturer to be installed on a recreational vessel. In our 1999 Tier 2 marine diesel engine rule, we defined recreational vessel as a vessel intended by the vessel operator to be operated primarily for pleasure or leased to another for the latter's pleasure, with the exception of (i) vessels less than 100 gross tons that carry more than six passengers; and (ii) vessels more than 100 gross tons that carry one or more passengers, where passenger means someone who pays to be on the vessel.

The goal of this definition was to exclude so-called recreational vessels that are in fact operated like commercial vessels: Those that are operated many hours a year (for example, charter fishing vessels and smaller tour vessels that are rented on an individual basis, with or without a crew). A personal vessel owned by an individual for his personal use and not for hire was intended to be considered to be a recreational vessel. For smaller vessels, this is achieved by requiring that there be fewer than six paying passengers; this allows an individual to invite friends onboard his or her vessel in return for some pecuniary arrangement (e.g., paying for the gas). For larger vessels, above 100 gross tons, the presence of any paying passenger prevents the vessel from being characterized as recreational; this is intended to cover luxury yachts that recover costs by taking paying passengers onboard. The specified paying passenger thresholds are high enough to make them likely to be known at the time the vessel is purchased.

In the 2003 rule, we revised the definition of recreational vessel, by adding a reference to the Coast Guard definition. However, the Coast Guard definition and EPA's definition have different intents. Coast Guard's requirements are safety related to ensure adequate lifesaving equipment is onboard a recreational vessel. For example, the Coast Guard definitions differentiate between charter and noncharter vessels based on whether vessels are operated with or without a crew. The intent of EPA's approach is to identify those vessels that are intended for pleasure as opposed to commercial applications. Thus our definition needs to rely on features that can be known at the time of manufacture. For example, by setting a six passenger threshold for small vessels our intent was to identify those vessels clearly identified by the manufacturer as being intended for charter use and not used as a charter either incidentally or unintentionally.

Since the Coast Guard definitions do not reflect the intent of EPA's program and are inconsistent with EPA's definitions, we are revising the definitions to remove the references to the Coast Guard definitions and reverting back to the original definitions adopted in 1999. While the new definition is being adopted in part 1042, § 94.12(i) of part 94 will allow manufacturers to use this new definition for certification under part 94. Commercial vessels that were categorized as recreational prior to that time due to confusion about the meaning of the definitions will not be affected by the revised definitions.

(11) Engine Stockpiling by Vessel Builders

Our existing marine diesel engine program specifies in § 94.1103(a)(5) that it is a prohibited act to introduce into commerce a new vessel containing an engine not covered by a certificate of conformity applicable for an engine model year the same as or later than the calendar year in which the manufacture of the new vessel is initiated.[169] However, as an exception, we allow vessel manufacturers to use up their normal inventory of engines not certified to new, more stringent emission standards if they were built before the date on which the new standards apply (subject to stockpiling prohibitions). With the adoption of the Tier 3 and 4 emission standards, the location of this provision transfers to § 1068.101(a)(1), including the exception noted above, now being located in § 1068.105(a).

The normal inventory approach above was developed in response to traditional business practice in automotive and other industries where vehicles and equipment are serially manufactured. Although this scheme works well for most manufacturers of small, serially-produced marine vessels, its application to manufacturers of large, commercial marine vessels may not be so straightforward. In this latter case there are typically long lead-time build schedules and low production volumes, which translate to vessel manufacturers maintaining lean inventory onsite at the shipyard. Vessel manufacturers usually order engines from dealers upon entering into a vessel construction agreement with an end customer. Due to lengthy build schedules, which for many projects can be counted in years, and the location of some shipyards in low-lying coastal areas subject to seasonal flooding, engines are often delivered and warehoused at the dealers' offsite location until such time as the vessels are ready to receive them for installation. Especially in projects where construction agreements involve multiple vessels, engines for all vessels may be ordered and delivered to the dealer during the same year in which construction of the first vessel is initiated. Due to this type of business practice, we will allow vessel manufacturers to consider as part of their normal inventory those engines that are warehoused at offsite dealerships and for which the vessel manufacturer entered into a purchase agreement prior to a change in applicable emission standards, provided this practice is consistent with the vessel manufacturers past engine ordering practices. We will allow this normal inventory of engines to be used up after new emission standards apply. It should be noted, however, that this clarification does not extend to engines that are not the subject of a prior purchase agreement, and would not allow a vessel manufacturer to search for a previous tier engine among engine dealers to evade the standards. Also, if a dealer has previous tier engines that are not the subject of a prior purchase agreement after a new tier of standards goes into effect, those engines may be used only as replacement engines, subject to § 1042.615; those engines may not be sold for use in new vessels.

(12) Other Issues

Several commenters, including the United States Coast Guard, raised questions regarding the possibility that advanced aftertreatment based emission control systems for marine diesel engines may need to be by-passed or otherwise modified or disabled in order to guarantee safe operation under emergency conditions. In general terms, the commenters speculated that the catalyst systems could fail in such a manner as to restrict exhaust flow reducing engine power and potentially endangering vessel safety.

Marine vessels that lose power to a main propulsion engine or generating engine providing essential power to main propulsion engine auxiliaries could go adrift with almost no control. Unlike trucks and locomotives, marine vessels have no brakes and can literally ''coast'' for miles and due to their enormous tonnage have an incredible amount of momentum and can cause catastrophic damage via collisions, allisions, and groundings. In the past, main propulsion failures on marine vessels have resulted in severe loss of life, property, and damage to the marine environment. Due to this precedent, a loss of main propulsion is defined as a ''marine casualty or accident'' in 46 CFR 4.03–1(b)(2)(ix) and 46 CFR 4.05–1 requires the occurrence to be immediately reported to the Coast Guard. To avoid potential loss of propulsion 46 CFR 58.01–35 effectively requires that main propulsion auxiliary machinery be provided in duplicate to prevent single point of failure.

Our discussions with the engine manufacturers regarding the technologies they expect to use to comply with the rules we are finalizing today, lead us to conclude that such failure mechanisms are extremely unlikely given the robust nature of the technologies.[170] However, reflecting the high priority everyone places on safety and the reality that no one can say today with absolute certainty how emission control systems will be designed in the future, we are continuing several regulatory provisions that further ensure safe vessel operation under all circumstances. Consistent with Coast Guard's requirements for main propulsion auxiliary machinery, we feel these provisions address the single point of failure concern in the design of emission control systems.

First, we are continuing our general regulatory requirement found in § 1042.115(e) stating that a manufacturer may not design engines with emission-control devices, systems, or elements of design that cause or contribute to an unreasonable risk to public health, welfare, or safety while operating. Likewise, our regulations continue to make clear that actions taken by the operators of marine vessels in order to respond to a temporary emergency will not be considered tampering under § 1068.101(b)(1) provided the system is returned to its proper function as soon as possible. Lastly, in evaluating auxiliary emission control devices (AECDs) for marine diesel engines we will continue to recognize that AECDs, such as those that eliminate a single point of failure, are not defeat devices as defined under § 1042.115(f) if the AECDs are necessary to prevent engine (or vessel) damage or accidents. In the case of AECD approval, we will continue our current practice of reviewing manufacturer certification applications to ensure that these provisions are only used when necessary. Further, it is our general expectation that engine manufacturers will provide diagnostic systems to alert vessel operators when such AECDs are active and if the AECD requires the operator to take an action, the diagnostic system should give the vessel operator as much advance warning as reasonably possible.

V. Costs and Economic Impacts

In this section, we present the projected cost impacts and cost effectiveness of the standards, and our analysis of the expected economic impacts on affected markets. The projected benefits and benefit-cost analysis are presented in Section VI. The benefit-cost analysis explores the net yearly economic benefits to society of the reduction in mobile source emissions expected to be achieved by

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[169] The manufacture of a vessel is initiated when the keel is laid, or the vessel is at a similar stage of construction. ''A similar stage of construction'' means: (1) the stage at which construction identifiable with a specific vessel begins, and (2) assembly of that vessel has commenced comprising at least 50 tons or one percent of the estimated mass of all structural material, whichever is less.

[170] We should note here that the standards in our rules are performance-based rather than a prescription for the application of a specific technology. Our rules do not prevent a manufacturer from developing and applying new or different technology at some future time as long as it meets the performance basis in the rules (e.g., a 0.04 g/kW-hr standard PM).

this rulemaking. The economic impact analysis explores how the costs of the rule will likely be shared across the manufacturers and users of the engines and equipment that will be affected by the standards. Unless noted otherwise, all costs are in 2005 dollars.

The annual monetized health benefits of this rule in 2030 will range from $9.2 and $11 billion, assuming a 3 percent discount rate, or between $8.4 billion to $10 billion, assuming a 7 percent discount rate. The social costs of the new standards are estimated to be approximately $738 million in 2030.[171] The impact of these costs on society are estimated to be small, with the prices of rail and marine transportation services estimated to increase by about 1 percent.

Further information on these and other aspects of the economic impacts of our final rule are summarized in the following sections and are presented in more detail in the Final RIA for this rulemaking.

A. Engineering Costs

The following sections briefly discuss the various engine and equipment cost elements considered for this cost analysis and present the total engineering costs we have estimated for this rulemaking; the reader is referred to Chapter 5 of the final RIA for a complete discussion of our engineering cost estimates. When referring to ''equipment'' costs throughout this discussion, we mean the locomotive and/or marine vessel related costs as opposed to costs associated with the diesel engine being placed into the locomotive or vessel. Estimated freshly manufactured engine and equipment engineering costs depend largely on both the size of the piece of equipment and its engine, and on the technology package being added to the engine to ensure compliance with the standards. The wide size variation of engines covered by this program (e.g., small marine engines with less than 37 kW (50 horsepower, or hp) through locomotive and marine C2 engines with over 3000 kW (4000 hp) and the broad application variation (e.g., small pleasure crafts through large line haul locomotives and cargo vessels) that exists in these industries makes it difficult to present an estimated cost for every possible engine and/or piece of equipment. Nonetheless, for illustrative purposes, we present some example per engine/equipment engineering cost impacts throughout this discussion. This engineering cost analysis is presented in detail in Chapter 5 of the final RIA.

Note that the engineering costs here do not reflect changes to the fuel used to power locomotive and marine engines. Our Nonroad Tier 4 rule (69 FR 38958) controlled the sulfur level in all nonroad fuel, including that used in locomotives and marine engines. The sulfur level in the fuel is a critical element of the locomotive and marine program. However, since the costs of controlling locomotive and marine fuel sulfur have been considered in our Nonroad Tier 4 rule, they are not considered here. This analysis considers only those costs associated with the locomotive and marine program being finalized today. Also, the engineering costs presented here do not reflect any savings that are expected to occur because of the engine ABT program and the various flexibilities included in the program which are discussed in section IV of this preamble. As discussed there, these program features have the potential to provide savings for both engine and locomotive/vessel manufacturers.

(1) Freshly Manufactured Engine and Equipment Variable Engineering Costs

Engineering costs for exhaust emission control devices (i.e., catalyzed DPFs, SCR systems, and DOCs) were estimated using a methodology consistent with the one used in our 2007 heavy-duty highway rulemaking. In that rule, surveys were provided to nine engine manufacturers seeking information relevant to estimating the engineering costs for and types of emission-control technologies that might be enabled with ultra low-sulfur diesel fuel (15 ppm S). The survey responses were used as the first step in estimating the engineering costs of advanced emission control technologies anticipated for meeting the 2007 heavy-duty highway standards. We then built upon these engineering costs using input from members of the Manufacturers of Emission Controls Association (MECA). We also used this information in our recent nonroad Tier 4 (NRT4) rule. Because the anticipated emission control technologies expected to be used on locomotive and marine engines are the same as or similar to those expected for highway and nonroad engines, and because the expected suppliers of the technologies are the same for these engines, we have used that analysis as the starting point for estimating the engineering costs of these technologies in this rule.[172] Importantly, the analysis summarized here and detailed in the final RIA takes into account specific differences between the locomotive and marine products when compared to on-highway trucks (e.g., engine size).

Engineering costs of control include variable costs (for new hardware, its assembly, and associated markups) and fixed costs (for tooling, research, redesign efforts, and certification). We are projecting that the Tier 3 standards will be met by optimizing the engine and emission controls that will exist on locomotive and marine engines in the Tier 3 timeframe. Therefore, we have estimated no hardware costs associated with the Tier 3 standards. For the Tier 4 standards, we are projecting that SCR systems and DPFs will be the most likely technologies used to comply. Upon installation in a new locomotive or a new marine vessel, these devices would require some new equipment related hardware in the form of brackets, new sheet metal, and a reductant storage and delivery system. The annual variable costs for example years, the PM/NO_X split of those engineering costs, and the net present values that would result are presented in Table V–1.[173] As shown, we estimate the net present value for the years 2006 through 2040 of all variable costs at $1.5 billion using a three percent discount rate, with $1.3 billion of that being engine-related variable costs.[174] Using a seven percent discount rate, these costs are $674 million and $575 million, respectively.

[171] The estimated 2030 social welfare cost of $738 million is based on draft compliance costs for this final rule of $740 million for that year. The final compliance cost estimate for 2030 is somewhat higher, at $759 million; see section VI.C for an explanation. This difference is not expected to have an impact on the results of the market analysis or on the expected distribution of social costs among stakeholders.

[172] ''Economic Analysis of Diesel Aftertreatment System Changes Made Possible by Reduction of Diesel Fuel Sulfur Content,'' Engine, Fuel, and Emissions Engineering, Incorporated, December 15, 1999, Public Docket No. A–2001–28, Docket Item II–A–76.

[173] The PM/NO_X+NMHC cost allocations for variable costs used in this cost analysis are as follows: SCR systems including marinization costs on marine applications are 100% NO_X+NMHC; DPF systems including marinization costs on marine applications are 100% PM; and, equipment hardware costs are split evenly.

[174] Throughout our cost and economic impact analyses, net present value (NPV) calculations are based on the period 2006–2040, reflecting the period when the NPRM analysis was completed. This has the consequence of discounting the current year costs, effectively 2007, and all subsequent years are discounted by an additional year. The result is a slightly smaller NPV of engineering costs than by calculating the NPV over 2007–2040 (3% smaller for 3% NPV and 7% smaller for 7% NPV). The same convention applies for the emission inventories as shown in Table V–7. We have used 2006 because we intended to publish the proposal in 2006. For the final analysis, we have chosen to continue with 2006 to make comparisons between proposal and final analyses more clear.

TABLE V–1.—FRESHLY MANUFACTURED ENGINE AND EQUIPMENT VARIABLE ENGINEERING COSTS

[Millions of 2005 dollars]

Year	Engine variable engineering costs	Equipment variable engineering costs	Total variable engineering costs	Total for PM	Total for NO_X+NMHC
2008	$0	$0	$0	$0	$0
2009	$0	$0	$0	$0	$0
2010	$0	$0	$0	$0	$0
2011	$0	$0	$0	$0	$0
2012	$0	$0	$0	$0	$0
2015	$60	$11	$71	$37	$34
2020	$82	$14	$96	$50	$46
2030	$99	$18	$117	$61	$56
2040	$98	$17	$115	$60	$55
NPV at 3%	$1,255	$220	$1,475	$772	$703
NPV at 7%	$575	$100	$674	$353	$321

We can also look at these variable engineering costs on a ''per engine'' and a ''per piece of equipment'' basis rather than an annual total basis. Doing so results in the costs summarized in Table V–2. The costs shown represent the total engine-related and equipment-related engineering hardware costs associated with all of the new emissions standards to which the given power range and market segment would need to comply. For example, a commercial marine engine below 600 kW (805 hp) would need to comply with the Tier 3 standards as its final tier and would, therefore, incur no new hardware costs. In contrast, a commercial marine engine over 600 kW is expected to comply with both Tier 3 and then Tier 4 and would, therefore, incur hardware costs associated with the Tier 4 standards. The costs also represent long term costs or those costs after expected learning effects have occurred and warranty costs have stabilized.

Table V-2 Long-term Variable Engineering Cost per New Engine & Piece of Equipment to Comply with the Final Tier of Standards (2005 dollars) [a]

Power Range	Locomotive Line haul	Locomotive Switcher [b]	C1 Marine	C2 Marine
Engine Costs ($/engine)				
600≤kW<1500	NA [c]	NA	$11,540	$29,960
≥1500 kW	$54,630	$13,640	$20,050	$55,750
# of engines/piece of equipment				
600≤kW<1500	NA	NA	2	2
≥1500 kW	1	1	2	2
Equipment Costs ($/piece of equipment for Tier 4 engines)				
600≤kW<1500	NA	NA	$23,070	$59,910
≥1500 kW	$54,630	$13,640	$40,110	$111,510
Equipment Costs ($/piece of equipment to accommodate Tier 4 engines)				
600≤kW<1500	NA	NA	$5,500	$5,500
≥1500 kW	$10,400	$7,500	$10,400	$10,400
Total Variable Cost ($/piece of equipment)				
600≤kW<1500	NA	NA	$28,570	$65,420
≥1500 kW	$65,020	$21,140	$50,490	$121,890

Notes:

(a) We have estimated no variable engineering costs associated with the Tier 3 standards and none associated with the Tier 4 standards for power ranges below 600 kW (800 hp) or for the recreational marine and small commercial marine categories.

(b) Locomotive switchers generally use land-based nonroad engines (i.e., NRT4 engines); therefore, we have used NRT4 cost estimates for locomotive switchers in this rulemaking.

(c) NA (not applicable) means there are no engines in that market segment/power range.

(2) Freshly Manufactured Engine and Equipment Fixed Engineering Costs

Because these technologies are being researched for implementation in the highway and nonroad markets well before the locomotive and marine emission standards take effect, and because engine manufacturers will have had several years complying with the highway and nonroad standards, we believe that the technologies used to comply with the locomotive and marine standards will have undergone significant development before reaching locomotive and marine production, and we have considered this in estimating the costs for research and development. Chapter 5 of the final RIA details our approach which differs from our approach in the draft RIA. We anticipate that engine manufacturers would introduce a combination of primary technology upgrades to meet the new emission standards. Achieving very low NO_X emissions requires basic research on NO_X emission-control technologies and improvements in engine management. There would also have to be some level of tooling expenditures to make possible the fitting of new hardware on locomotive and marine engines. We also expect that locomotives and marine vessels being fitted with Tier 4 engines would have to undergo some level of redesign to accommodate the aftertreatment devices expected to meet the Tier 4 standards.

The total of fixed engineering costs and the net present values of those costs are shown in Table V–3.[175] As shown, we have estimated the net present value for the years 2006 through 2040 of all fixed engineering costs at $549 million using a three percent discount rate, with $471 million of that being engine-related research costs. Using a seven percent discount rate, these costs are $422 million and $371 million, respectively.

TABLE V–3.—FRESHLY MANUFACTURED ENGINE AND EQUIPMENT FIXED ENGINEERING COSTS

[Millions of 2005 dollars]

Year	Engine research	Engine tooling	Engine certification	Equipment redesign	Total fixed engineering costs	Total for PM	Total for NO_X +NMHC
2008	$34	$0	$0	$0	$34	$11	$23
2009	34	0	0	0	34	11	23
2010	68	0	0	0	68	23	46
2011	114	19	5	0	138	50	88
2012	80	0	0	0	80	27	54
2015	46	17	1	13	76	30	46
2020	0	0	0	3	3	1	1
2030	0	0	0	3	3	1	1
2040	0	0	0	0	0	0	0
NPV at 3%	471	33	6	39	549	194	354
NPV at 7%	371	24	5	22	422	148	274

Some of the estimated fixed engineering costs would occur in years prior to the Tier 3 standards taking affect in 2012. Engine manufacturers would need to invest in engine tooling and certification prior to selling engines that meet the standards. Engine research is expected to begin five years in advance of the standards for which the research is done. We have estimated some engine research for both the Tier 3 and Tier 4 standards, although the research associated with the Tier 4 standards is expected to be higher since it involves work on aftertreatment devices which only the Tier 4 standards would require. By 2016, the Tier 4 standards would be fully implemented and engine research toward the Tier 4 standards would be completed. Similarly, engine tooling and certification efforts would be completed. We have estimated that equipment redesign, driven mostly by marine vessel redesigns, would continue for many years given the nature of the marine market. Therefore, by 2017 all engine-related fixed engineering costs would be zero, and by 2033 all equipment-related fixed engineering costs would be zero.

(3) Freshly Manufactured Engine Operating Costs

We anticipate an increase in costs associated with operating locomotives and marine vessels. We anticipate three sources of increased operating costs: Reductant use; DPF maintenance; and a fuel consumption impact. Increased operating costs associated with reductant use would occur only in those locomotives/vessels equipped with a SCR engine using a reductant like urea. Maintenance costs associated with the DPF (for periodic cleaning of accumulated ash resulting from unburned material that accumulates in the DPF) would occur in those locomotives/vessels that are equipped with a DPF engine. The fuel consumption impact is anticipated to occur more broadly—we expect that a one percent fuel consumption increase would occur for all new Tier 4 engines, locomotive and marine, due to higher exhaust backpressure resulting from aftertreatment devices. These costs and how the fleet cost estimates were generated are detailed in Chapter 5 of the final RIA and are summarized in Table V–4.[176]

TABLE V–4.—FRESHLY MANUFACTURED ENGINE ESTIMATED INCREASED OPERATING COSTS

[Millions of 2005 dollars]

Year	Reductant use	DPF maintenance	Fuel consumption impact	Total operating costs	Total for PM	Total for NO_X+NMHC
2008	$0	$0	$0	$0	$0	$0
2009	0	0	0	0	0	0
2010	0	0	0	0	0	0
2011	0	0	0	0	0	0
2012	0	0	0	0	0	0
2015	23	0	7	30	4	26

[175] The PM/NO_X+NMHC cost allocations for fixed costs used in this cost analysis are as follows: Engine research expenditures are 67% NO_X+NMHC and 33% PM; engine tooling and certification costs are split evenly; and, equipment redesign costs are split evenly.

[176] The PM/NO_X+NMHC cost allocations for operating costs used in this cost analysis are as follows: Reductant costs are 100% NO_X+NMHC; DPF maintenance costs are 100% PM; and, fuel consumption impacts are split evenly.

TABLE V–4.—FRESHLY MANUFACTURED ENGINE ESTIMATED INCREASED OPERATING COSTS—Continued

[Millions of 2005 dollars]

Year	Reductant use	DPF maintenance	Fuel consumption impact	Total operating costs	Total for PM	Total for NO_X+NMHC
2020	143	3	42	187	24	164
2030	409	8	118	535	67	468
2040	619	12	175	806	99	707
NPV at 3%	4,031	75	1,157	5,264	654	4,610
NPV at 7%	1,575	29	453	2,057	256	1,801

As shown, we have estimated the net present value for the years 2006 through 2040 of the annual operating costs at $5.2 billion using a three percent discount rate and $2.1 billion using a seven percent discount rate. The operating costs are zero until Tier 4 engines start being sold since only the Tier 4 engines are expected to incur increased operating costs (note that operating costs associated with the remanufacturing programs are discussed below). Reductant use represents the largest source of increased operating costs. Because reductant use is meant for controlling NO_X emissions, most of the operating costs are associated with NO_X+NMHC control.

(4) Engineering & Operating Costs Associated With the Remanufacturing Programs

We have also estimated engineering costs associated with the locomotive and marine remanufacturing programs. The remanufacturing process is not a low cost endeavor. However, it is much less costly than purchasing a freshly manufactured engine. The engineering costs we have estimated associated with the remanufacturing program are not meant to capture the remanufacturing process but rather the incremental engineering costs to that process. Therefore, the remanufacturing costs estimated here are only those engineering and operating costs resulting from the requirement to meet a more stringent standard than the engine was designed to meet at its original sale. In addition to incremental hardware costs, we expect that some remanufactured engines will see a fuel consumption impact. We expect a 1 percent fuel consumption increase will occur for remanufactured Tier 0 locomotives because we believe that the tighter NO_X standard will be met using retarded timing. For the same reason, we expect a 2 percent fuel consumption increase for remanufactured C2 marine engines. The marine engines will have timing retarded to the same degree as locomotives, but the relative degree of timing retard will be greater for marine engines given their initial state of control. These engineering and operating costs and how they were generated are detailed in Chapter 5 of the final RIA and are summarized in Table V–5.[177] As shown, we have estimated the net present value for the years 2006 through 2040 of the annual engineering and operating costs associated with the locomotive and marine remanufacturing programs at $2.1 billion using a 3 percent discount rate and $1.2 billion using a 7 percent discount rate.

TABLE V–5.—ESTIMATED HARDWARE AND OPERATING COSTS ASSOCIATED WITH THE LOCOMOTIVE & MARINE REMANUFACTURING PROGRAMS

[Millions of 2005 dollars]

Year	Locomotive	Marine	Total	Total for PM	Total for NO_X+NMHC
2008	$59	$16	$75	$38	$38
2009	32	21	54	27	27
2010	58	27	85	42	42
2011	111	32	143	71	71
2012	91	44	135	68	68
2015	52	37	89	44	44
2020	37	26	63	31	31
2030	94	12	106	53	53
2040	158	3	161	80	80
NPV at 3%	1,669	450	2,120	1,060	1,060
NPV at 7%	864	289	1,153	577	577

(5) Total Engineering & Operating Costs

The total engineering and operating costs associated with today's final rule are the summation of the new engine and new equipment engineering costs, both fixed and variable, the new engine operating costs for freshly manufactured engines, and the hardware and operating costs associated with the locomotive and marine remanufacturing programs. These costs are summarized in Table V–6.

[177] Costs associated with the remanufaturing program are split evenly between NO_X+NMHC and PM. Note that the costs associated with the marine remanufacturing program are consistent with the inventory reductions discussed in section II. Our estimate of the number of remanufactured engines is presented in a memorandum from Amy Kopin to the docket for this rule (see Docket Item No. EPA–HQ–OAR–2003–0190–0847).

TABLE V–6.—TOTAL ENGINEERING & OPERATING COSTS OF THE FINAL PROGRAM

(Millions of 2005 dollars]

Year	Freshly manufactured engine related engineering costs	Freshly manufactured equipment related engineering costs	Freshly manufactured engine & equipment operating costs	Hardware and operating costs associated with the remanufacturing programs	Total engineering costs	Total PM costs	Total NO_X+NMHC costs
2008	$34	$0	$0	$75	$109	$49	$60
2009	34	0	0	54	87	38	49
2010	68	0	0	85	153	65	88
2011	138	0	0	143	281	121	160
2012	80	0	0	135	215	94	121
2015	123	24	30	89	266	116	150
2020	82	17	187	63	349	106	242
2030	99	20	535	105	759	181	578
2040	98	17	806	161	1,082	240	842
NPV at 3%	1,764	260	5,264	2,120	9,407	2,680	6,727
NPV at 7%	974	122	2,057	1,153	4,307	1,333	2,973

As shown, we have estimated the net present value of the annual engineering costs for the years 2006 through 2040 at $9.4 billion using a 3 percent discount rate and $4.3 billion using a 7 percent discount rate. Roughly half of these costs are operating costs, with the bulk of those being reductant related costs. As explained above in the operating cost discussion, because reductant use is meant for controlling NO_X emissions, most of the operating costs and, therefore, the majority of the total engineering costs are associated with NO_X+NMHC control.

Figure V–1 graphically depicts the annual engineering costs associated with the program being finalized today. The engine costs shown represent the engineering costs associated with engine research and tooling, etc., and the incremental costs for new hardware such as DPFs and reductant SCR systems. The equipment costs shown represent the engineering costs associated with equipment redesign efforts and the incremental costs for new equipment-related hardware such as reductant storage and delivery systems, sheet metal and brackets. The remanufacturing program costs include incremental hardware and operating costs for the locomotive and marine remanufacturing programs. The operating costs include incremental increases in operating costs associated with reductant use, DPF maintenance, and a 1 percent fuel consumption increase for new Tier 4 engines. The total program engineering costs are shown in Table V–6 as $9.4 billion at a 3 percent discount rate and $4.3 billion at a 7 percent discount rate.

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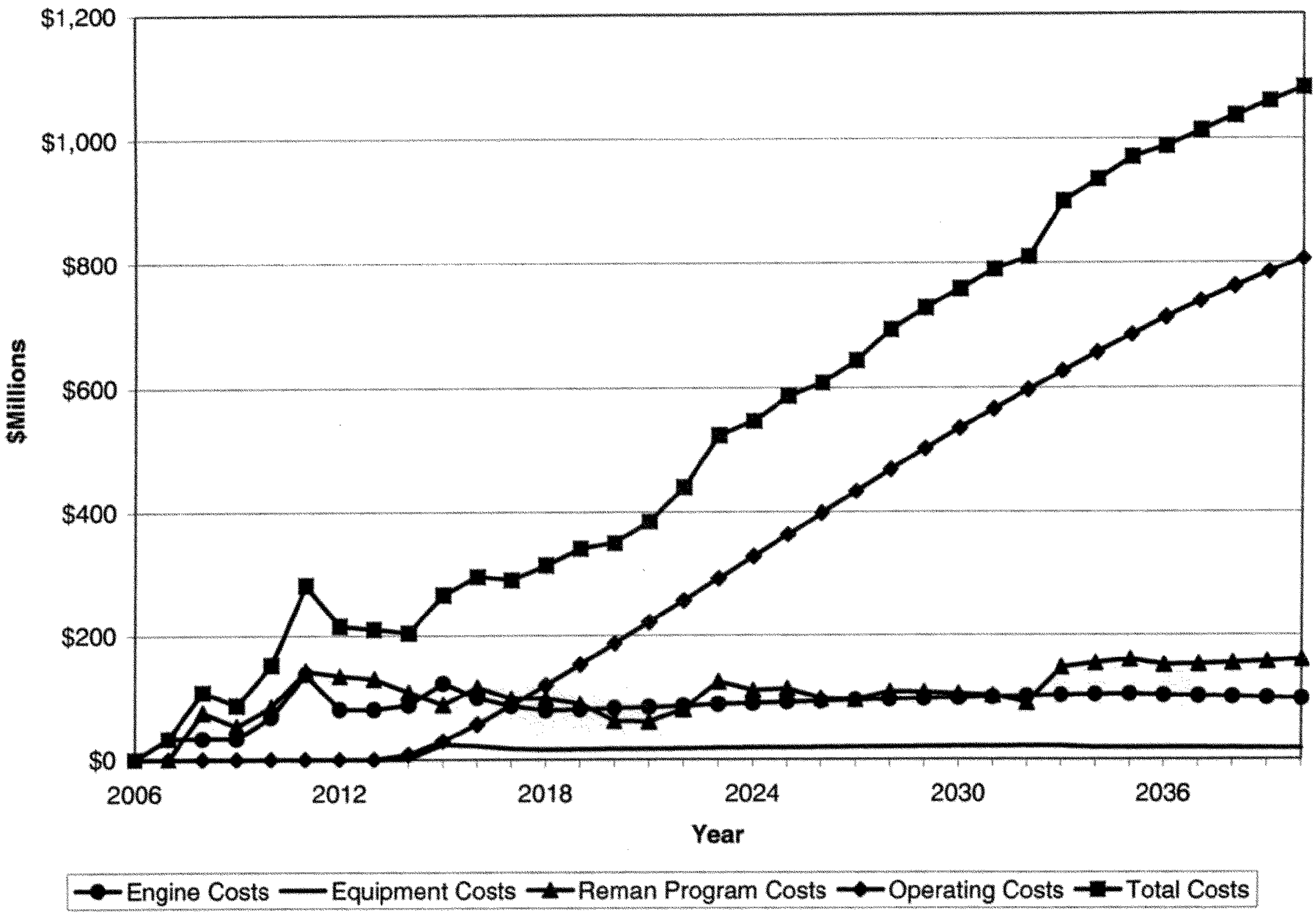
Figure V-1 Annual Engineering Costs of the New Engine Standards and Locomotive & Marine Remanufacturing Programs



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B. Cost Effectiveness

As discussed in section VI, this rule is very cost beneficial, with social benefits far outweighing social costs. However, this does not shed light on how cost effective this control program is compared to other control programs at providing the expected emission reductions. One tool that can be used to assess the value of the final program is the ratio of engineering costs incurred per ton of emissions reduced and comparing that ratio to other control programs. As we show in this section, the PM and NO_X emissions reductions from the new locomotive and marine diesel program compare favorably—in terms of cost effectiveness—to other mobile source control programs that have been or will soon be implemented.

We note that today's action builds upon the efforts undertaken by the engine manufacturing industry to comply with our recent 2007/2010 heavy-duty highway and nonroad Tier 4 (NRT4) rulemakings. As such, and as discussed at length in Chapter 5 of the final RIA, much of the research and development associated with diesel emission controls builds upon the work done to comply with those earlier rules. This does not change the conclusion that the cost effectiveness of today's action compares favorably with other actions deemed appropriate for society.

We have calculated the cost per ton of our program based on the net present value of all engineering costs incurred and all emission reductions generated from the current year 2006 through the year 2040. This approach captures all of the costs and emissions reductions from our program including those costs incurred and emissions reductions generated by the locomotive and marine remanufacturing programs. The baseline case for this evaluation is the existing set of engine standards for locomotive and marine diesel engines and the existing remanufacturing requirements. The analysis timeframe is meant to capture both the early period of the program when very few new engines that meet the standards would be in the fleet, and the later period when essentially all engines would meet the new standards.

Table V–7 shows the emissions reductions associated with today's rule. These reductions are discussed in more detail in section II of this preamble and Chapter 3 of the final RIA.

TABLE V–7.—ESTIMATED EMISSIONS REDUCTIONS ASSOCIATED WITH THE NEW LOCOMOTIVE AND MARINE PROGRAM

(Short tons)

Year	$PM_{2.5}$	PM_{10} [a]	NO_X	NMHC
2015	7,000	8,000	161,000	14,000
2020	14,000	15,000	371,000	26,000
2030	27,000	27,000	795,000	40,000
2040	37,000	38,000	1,144,000	52,000
NPV at 3%	308,000	318,000	8,757,000	492,000
NPV at 7%	134,000	139,000	3,708,000	221,000

Note: (a) Note that, $PM_{2.5}$ is estimated to be 97 percent of the more inclusive PM_{10} emission inventory.

In Section II we generate and present $PM_{2.5}$ inventories since recent research has determined that these are of greater health concern. Similarly, NMHC is estimated to be 93 percent of the more inclusive VOC emission inventory. Traditionally, we have used PM_{10} and NMHC in our cost effectiveness calculations. Since cost effectiveness is a means of comparing control measures to one another, we use PM_{10} and NMHC in our cost effectiveness calculations for comparisons to past control measures.

Using the engineering costs shown in Table V–6 and the emission reductions shown in Table V–7, we can calculate the $/ton associated with today's rule. These are shown in Table V–8. The resultant cost per ton numbers depend on how the engineering costs presented above are allocated to each pollutant. Therefore, as described in section V.A, we have allocated costs as closely as possible to the pollutants for which they are incurred. These allocations are also discussed in detail in Chapter 5 of the final RIA.

TABLE V–8.—FINAL PROGRAM AGGREGATE COST PER TON AND LONG-TERM ANNUAL COST PER TON

Pollutant	2006 thru 2040 discounted lifetime cost per ton at 3%	2006 thru 2040 discounted lifetime cost per ton at 7%	Cost per ton in 2030	Cost per ton in 2040
NO_X+NMHC	$730	$760	$690	$700
PM	8,440	9,620	6,620	6,360

The costs per ton shown in Table V–8 for 2006 through 2040 use the net present value of the annualized engineering costs and emissions reductions associated with the program for the years 2006 through 2040. We have also calculated the costs per ton of emissions reduced in the years 2030 and 2040 using the annual engineering costs and emissions reductions in those specific years. These numbers are also shown in Table V–8. All of the costs per ton include costs and emission reductions that will occur from the locomotive and marine remanufacturing programs.

In comparison with other emissions control programs, we believe that the new locomotive and marine program represents a cost effective strategy for generating substantial NO_X+NMHC and PM reductions. This can be seen by comparing the cost effectiveness with the cost effectiveness of a number of standards that EPA has adopted in the past. Table V–9 and Table V–10 summarize the cost per ton of several past EPA actions to reduce emissions of NO_X+NMHC and PM from mobile sources.

TABLE V–9.—NEW LOCOMOTIVE AND MARINE PROGRAM COMPARED TO PREVIOUS MOBILE SOURCE PROGRAMS FOR NO_X+NMHC

Program	$/ton NO_X+NMHC
Today's locomotive & marine standards	$730
Tier 4 Nonroad Diesel (69 FR 39131)	1,140
Tier 2 Nonroad Diesel (EPA420–R–98–016, Chapter 6)	710
Tier 3 Nonroad Diesel (EPA420-R–98–016, Chapter 6)	480
Tier 2 vehicle/gasoline sulfur (65 FR 6774)	1,580—2,650
2007 Highway HD (66 FR 5101)	2,530
2004 Highway HD (65 FR 59936)	250—480

Note: Costs adjusted to 2005 dollars using the Producer Price Index for Total Manufacturing Industries.

TABLE V–10.—NEW LOCOMOTIVE AND MARINE STANDARDS COMPARED TO PREVIOUS MOBILE SOURCE PROGRAMS FOR PM

Program	$/ton PM
Today's locomotive & marine standards	$8,440
Tier 4 Nonroad Diesel (69 FR 39131)	12,630
Tier 1/Tier 2 Nonroad Diesel (EPA420–R–98–016, Chapter 6)	2,700

TABLE V–10.—NEW LOCOMOTIVE AND MARINE STANDARDS COMPARED TO PREVIOUS MOBILE SOURCE PROGRAMS FOR PM—Continued

Program	$/ton PM
2007 Highway HD (66 FR 5101)	15,990

Note: Costs adjusted to 2005 dollars using the Producer Price Index for Total Manufacturing Industries.

C. EIA

We prepared an Economic Impact Analysis (EIA) to estimate the social costs associated with the final control program to estimate the market-level changes in prices and outputs for affected markets, the social costs of the program, and the expected distribution of those costs across stakeholders. As defined in EPA's *Guidelines for Preparing Economic Analyses*, social costs are the value of the goods and services lost by society resulting from (a) the use of resources to comply with and implement a regulation and (b) reductions in output.[178]

A quantitative Economic Impact Model (EIM) was developed to estimate price and quantity changes and total social costs associated with the emission control program.

The EIM is a computer model comprised of a series of spreadsheet modules that simulate the supply and demand characteristics of each of the markets under consideration. The model methodology is firmly rooted in applied microeconomic theory and was developed following the methodology set out in OAQPS's *Economic Analysis Resource Document*.[179] Chapter 7 of the RIA contains a detailed description of the EIM, including the economic theory behind the model and the data used to construct it, the baseline equilibrium market conditions, and the model's behavior parameters. The EIM and the estimated compliance costs presented above are used to estimate the economic impacts of the program. The results of this analysis are summarized below.

The engineering costs we used in the EIA are an earlier version of the estimated compliance costs developed for this final rule. The net present value of the engineering costs used in the EIA is estimated to be approximately $9.17 billion (NPV over the period of analysis at 3 percent discount rate), which is about $240 million less than the net present value of the final estimated engineering costs of about $9.41 billion. This difference is the sum of various cost adjustments, the largest of which are an increase of about $222 million in operating costs for the marine markets and $42 million in the operating costs for the rail markets (NPV over the period of analysis at 3 percent discount rate). These changes are not expected to have a substantial impact on the market level results because the differences are relatively small on an annual basis. For example, operating costs for C2 marine markets increase by about 15 percent in 2030 (from $107 million to $123 million). The previous estimate of $107 million was associated with an increase of approximately 1.1 in the price of marine transportation services and a decrease of approximately 0.5 percent in the quantity of marine transportation services provided. A small increase in operating costs is not likely to change those results by very much. The market-level impacts on the other downstream markets are also likely to be very small and not economically significant. Finally, the difference in compliance costs will not affect the distribution of social costs, which is a function of the price elasticity of supply and demand.

(1) Market Analysis Results

In the market analysis, we estimate how prices and quantities of goods and services affected by the emission control program can be expected to change once the program goes into effect.

The compliance costs associated with the new locomotive and marine diesel engine standards are expected to lead to price and quantity changes in these markets. A summary of the market analysis results is presented in Table V–11 for 2012, which is representative of the first year of the Tier 3 standards; 2016, which is representative of the first year of the Tier 4 standards; and 2030, which represents market impacts of the program in the long-term. Results for all years can be found in Chapter 7 of the RIA.

For all markets, the market impacts for the early years of the program are driven by the transportation markets. In these years, the only direct compliance costs are associated with the remanufacture programs; there are no variable costs associated with the Tier 3 standards and therefore no direct compliance costs. The transportation markets will experience operating costs increases; these will result in small increases in transportation market prices, which will translate to small contractions in demand for locomotives and marine diesel engines and vessels. This is expected exert marginal downward pressure on prices in those markets, of less than 0.1 percent. The production decreases are also expected to be very small, at 0.1 percent or less.

The Tier 4 programs are expected to result in larger market changes due to the direct compliance costs associated with Tier 4 standards and the continuing costs of the remanufacture programs. For the locomotive markets, the price increases in 2016 are expected to be about 4 percent for line haul locomotives and about one percent for switchers in 2016. In the long term (by 2030), prices are expected to increase to about 3.2 percent for line haul locomotives and about 1.5 percent for switchers. These small price increases reflect the relative amount of the compliance costs compared to the total cost of a locomotive or switcher (the engine is only a small part of the total cost of the locomotive). In all cases, the decrease in the quantity of line haul locomotives or switchers produced is expected to be less than 0.5 percent.

In the marine markets, price increases for engines are expected to be larger in 2016, varying from about 9 percent for C1 engines above 600 kW (800 hp) to 17 percent for auxiliary engines and C2 engines above 600 kW.[180] The price increases for vessels that use these engines, however, are smaller (about 2 percent and 7 percent, respectively), reflecting the relative amount of the compliance costs compared to the price of a commercial marine vessel. Production quantities are expected to decrease by less than 4 percent for engines and vessels. The long-term price impacts are similar, with expected price increases of about 12 percent for engines C2 above 600 kW and 7 percent for C1 engines above 600 kW, and vessel price

[178] EPA Guidelines for Preparing Economic Analyses, EPA 240–R–00–003, September 2000, p 113. A copy of this document can be found at *http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html.*

[179] U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, OAQPS Economic Analysis Resource Document, April 1999. A copy of this document can be found at *http://www.epa.gov/ttn/ecas/econdata/Rmanual2/.*

[180] Results presented in this section are by marine engine category in kW; the actual EIA analysis presented in Chapter 7 of the RIA was performed using marine engine categories by hp.

increases of less than 5 percent. Long-term production quantity decreases are expected to be less than 3 percent.

TABLE V–11.—ESTIMATED MARKET IMPACTS FOR 2012, 2016, 2030
(2005$)

Market[c]	Average variable engineering cost per unit	Change in price		Change in quantity	
		Absolute	Percent	Absolute	Percent
2012					
Rail Sector:					
Locomotives	$0	−535	−0.03	−1	−0.1
Switcher/Passenger	0	−348	−0.03	0	−0.1
Transportation Services	NA	[a] NA	0.1	[a] NA	−0.1
Marine Sector					
Engines:					
Auxiliary >600 kW	0	−47	0.00	0	−0.1
C1>600 kW	0	−8	0.00	0	0.0
C2>600 kW	0	−139	−0.03	0	−0.1
Other marine	0	0	0.00	0	0.0
Vessels					
C1>600 kW	0	−174	−0.01	0	0.0
C2>600 kW	0	−2,419	−0.07	0	−0.1
Other marine	0	−3	0.00	1	0.0
Transportation Services	NA	[a] NA	0.2	[a] NA	−0.1
2016					
Rail Sector:					
Locomotives	84,274	83,227	4.2	−1	−0.1
Switcher/Passenger	14,175	13,494	1.0	0	−0.1
Transportation Services	NA	[a] NA	0.3	[a] NA	−0.1
Marine Sector					
Engines:					
Auxiliary >600 kW	37,097	35,569	17.1	−11	−3.4
C1>600 kW	18,483	16,384	8.5	−15	−3.7
C2>600 kW	71,806	71,602	16.3	0	−0.2
Other marine	0	0	0.00	0	0.0
Vessels:					
C1>600 kW	8,277	[b] 34,043	2.1	−14	−3.7
C2>600 kW	12,107	[b] 255,143	7.0	0	−0.2
Other marine	0	−4	0.00	−1	0.0
Transportation Services	NA	[a] NA	0.4	[a] NA	−0.2
2030					
Rail Sector:					
Locomotives	65,343	63,019	3.2	−4	−0.3
Switcher/Passenger	21,139	19,628	1.5	−1	−0.3
Transportation Services	NA	[a] NA	0.6	[a] NA	−0.3
Marine Sector					
Engines:					
Auxiliary >600 kW	28,359	27,021	13.0	−11	−2.8
C1>600 kW	14,131	12,479	6.5	−13	−2.9
C2>600 kW	54,893	54,264	12.3	−1	−0.5
Other marine	0	−1	0.0	0	0.0
Vessels:					
C1>600 kW	6,933	[b] 25,768	1.6	−12	−2.9
C2>600 kW	10,169	[b] 164,774	5.1	0	−0.5
Other marine	0	−12	0.0	−4	0.0
Transportation Services	NA	[a] NA	1.1	[a] NA	−0.5

Notes:
[a] The prices and quantities for transportation services are normalized (1 for 1 unit of services provided) and therefore it is not possible to estimate the absolute change price or quantity; see 7.3.1.5.
[b] The estimated vessel impacts include the impacts of direct vessel compliance costs and the indirect impacts of engine markets for both propulsion and auxiliary engines. See Chapter 7 of the RIA.
[c] Results presented in this table are by marine engine category in kW; the actual EIA analysis presented in Chapter 7 of the RIA was performed using marine engine categories by hp.

(2) Economic Welfare Analysis

In the economic welfare analysis, we look at the total social costs associated with the program and their distribution across key stakeholders.

The total estimated social costs of the program are about 221 million, 284 million, $332 million and 738 million for 2012, 2016, 2020, and 2030. These estimated social costs are nearly identical to the total compliance costs for those years. The slight reduction in social costs when compared to compliance costs occurs because the total engineering costs do not reflect the decreased sales of locomotives, engines and vessels that are incorporated in the total social costs. Results for all years are presented in Chapter 7 of the RIA.

Table V–12 shows how total social costs are expected to be shared across stakeholders for selected years.

We estimate the net social costs of the program to be approximately $738 million in 2030.[181] The rail sector is expected to bear about 62.5 percent of the social costs of the program in 2030, and the marine sector is expected to bear about 37.5 percent. In each of these two sectors, these social costs are expected to be born primarily by producers and users of locomotive and marine transportation services (about 98 percent). The remaining 2 percent is expected to be borne by locomotive, marine engine, and marine vessel manufacturers and fishing and recreational users.

TABLE V–12.—SUMMARY OF ESTIMATED SOCIAL COSTS FOR 2012, 2016, 2020, 2030 (2005$, $MILLION)

Stakeholder group [a]	2012		2016	
	Surplus change	Percent	Surplus change	Percent
Locomotives:				
Locomotive producers	−35.1	15.9	−8.3	2.9
Line haul producers	−27.8	12.6	−0.9	0.3
Switcher/Passenger producers	−7.2	3.3	−7.4	2.6
Rail transportation service providers	−21.4	9.7	−43.4	15.3
Rail transportation service consumers	−68.4	31.0	−138.9	48.8
Total locomotive sector	−124.9	56.6	−190.6	67.0
Marine:				
Marine engine producers	−45.8	20.7	−2.1	0.7
Auxiliary > 600 kW	−16.0	7.3	−0.5	0.2
C1 > 600 kW	−19.0	8.6	−1.6	0.5
C2 > 600 kW	−10.7	4.9	−0.0	0.0
Other marine	0.0	0.0	0.0	0.0
Marine vessel producers	−0.3	0.1	−15.8	5.6
C1 > 600 kW	−0.1	0.0	−13.5	4.7
C2 > 600 kW	−0.1	0.1	−2.2	0.8
Other marine	−0.1	0.0	−0.1	0.0
Recreational and fishing vessel consumers	0.0	0.0	0.0	0.0
Marine transportation service providers	−11.9	5.4	−18.1	6.4
Marine transportation service consumers	−38.1	17.3	−57.9	20.3
Auxiliary engines > 600 kW	0.0	0.0	0.0	0.0
Total marine sector	−96.1	43.5	−93.8	33.0
Total Program	−221.0	....	−284.4	....
Stakeholder group	**2020**		**2030**	
	Surplus	Percent	Surplus	Percent
Locomotives:				
Locomotive producers	−1.1	0.3	−3.1	0.4
Line haul producers	−1.0	0.3	−2.7	0.4
Switcher/Passenger producers	−0.1	0.0	−0.4	0.1
Rail transportation service providers	−46.4	14.0	−109.0	14.8
Rail transportation service consumers	−148.6	44.8	−348.9	47.3
Total locomotive sector	−196.1	59.1	−461.1	62.5
Marine:				
Marine engine producers	−1.8	0.5	−2.0	0.3
Auxiliary > 600 kW	−0.4	0.1	−0.5	0.1
C1 > 600 kW	−1.3	0.4	−1.4	0.2
C2 > 600 kW	0.0	0.0	−0.1	0.0
Other marine	0.0	0.0	0.0	0.0
Marine vessel producers	−10.3	3.1	−9.2	1.2
C1 > 600 kW	−8.8	2.7	−8.2	1.1
C2 > 600 kW	−1.3	0.4	−0.7	0.1
Other marine	−0.1	0.0	−0.3	0.0
Recreational and fishing vessel consumers	0.0	0.0	0.0	0.0
Marine transportation service providers	−29.5	8.9	−63.3	8.6
Marine transportation service consumers	−94.4	28.4	−202.5	27.4
Auxiliary engines > 600 kW	0.0	0.0	0.0	0.0
Total marine sector	−135.9	40.9	−277.0	37.5
Total Program	−332.0	....	−738.1	....

Note: [a] Results presented in this table are by marine engine category in kW; the actual EIA analysis presented in Chapter 7 of the RIA was performed using marine engine categories by hp.

[181] All estimates presented in this section are in 2005$.

Table V–13 shows the distribution of total surplus losses for the program from 2007 through 2040. This table shows that the rail sector is expected to bear about 62 percent of the total program social costs through 2040 (NPV 3%), and that most of the costs are expected to be borne by the rail transportation consumers. The marine sector is expected to bear about 38 percent of the total program social costs through 2040 (NPV 3%), most of which are also expected to be borne by the marine transportation consumers. This is consistent with the structure of the program, which leads to high compliance costs for the rail marine transportation sectors.

TABLE V–13. ESTIMATED NET SOCIAL COSTS 2007 THROUGH 2040 BY STAKEHOLDER ($MILLION, 2005$)

Stakeholder Groups [a]	Surplus change	Percent of total surplus	Surplus change	Percent of total surplus
Locomotives	NPV 3%		NPV 7%	
Locomotive producers	−$221.1	2.4	−$160.4	3.8
Line Haul	−172.2		−124.5	
Switcher/Passenger	−48.9		−35.9	
Rail transportation service providers	−1,302.7	14.2	−568.6	13.6
Rail transportation service consumers	−4,168.7	45.6	−1,819.5	43.5
Total locomotive sector	−5,692.6	62.6	−2,548.5	61.0
Marine				
Marine engine producers	−307.5	3.4	−229.4	5.5
Auxiliary > 600 kW	−87.3		−64.0	
C1 > 600 kW	−106.8		−74.6	
C2 > 600 kW	−56.8		−42.6	
Other marine	−56.7		−48.1	
Marine vessel producers	−150.0	1.6	−72.5	1.7
C1 > 600 kW	−126.8		−60.8	
C2 > 600 kW	−19.7		−10.2	
Other marine	−3.5		−1.5	
Recreational and fishing vessel consumers	0.2		0.1	
Marine transportation service providers	−704.6	7.7	−308.4	7.4
Marine transportation service consumers	−2,254.7	24.6	−986.9	23.6
Auxiliary Engines <600 kW	−40.2	0.4	−34.2	−0.8
Total marine sector	3,456.7	37.8	−1,631.3	39.0
Total Program	−9.149.2		−4,179.8	

Note: [a] Results presented in this table are by marine engine category in kW; the actual EIA analysis presented in Chapter 7 of the RIA was performed using marine engine categories by hp.

(3) What Are the Significant Limitations of the Economic Impact Analysis?

Every economic impact analysis examining the market and social welfare impacts of a regulatory program is limited to some extent by limitations in model capabilities, deficiencies in the economic literatures with respect to estimated values of key variables necessary to configure the model, and data gaps. In this EIA, there three potential sources of uncertainty: (1) Uncertainty resulting from the way the EIM is designed, particularly from the use of a partial equilibrium model; (2) uncertainty resulting from the values for key model parameters, particularly the price elasticity of supply and demand; and (3) uncertainty resulting from the values for key model inputs, particularly baseline equilibrium price and quantities.

Uncertainty associated with the economic impact model structure arises from the use of a partial equilibrium approach, the use of the national level of analysis, and the assumption of perfect competition. These features of the model mean it does not take into account impacts on secondary markets or the general economy, and it does not consider regional impacts. The results may also be biased to the extent that firms have some control over market prices, which would result in the modeling over-estimating the impacts on producers of affected goods and services.

The values used for the price elasticities of supply and demand are critical parameters in the EIM. The values of these parameters have an impact on both the estimated change in price and quantity produced expected as a result of compliance with the new standards and on how the burden of the social costs will be shared among producer and consumer groups. In selecting the values to use in the EIM it is important that they reflect the behavioral responses of the industries under analysis.

Finally, uncertainty in measurement of data inputs can have an impact on the results of the analysis. This includes measurement of the baseline equilibrium prices and quantities and the estimation of future year sales. In addition, there may be uncertainty in how similar engines and equipment were combined into smaller groups to facilitate the analysis. There may also be uncertainty in the compliance cost estimations.

While variations in the above model parameters may affect the distribution of social costs among stakeholders and the estimated market impacts, they will not affect the total social costs of the program. This is because the total social costs are directly related to the total compliance costs. To explore the effects of key sources of uncertainty on the distribution of social costs and on estimated price and quantity impacts, we performed a sensitivity analysis in which we examine the results of using alternative values for several model parameters. The results of these analyses are contained in Appendix 7H of the RIA prepared for this rule.

Despite these uncertainties, we believe this economic impact analysis provides a reasonable estimate of the expected market impacts and social welfare costs of the new standards in future. Acknowledging benefits omissions and uncertainties, we present a best estimate of the social costs based on our interpretation of the best available scientific literature and methods supported by EPA's Guidelines for Preparing Economic Analyses and the OAQPS Economic Analysis Resource Document.

VI. Benefits

This section presents our analysis of the health and environmental benefits that are estimated to occur as a result of the final locomotive and marine engine standards throughout the period from initial implementation through 2030. Nationwide, the engines that are subject to the emission standards in this rule are a significant source of mobile source air pollution. The standards will reduce exposure to NO_X and direct PM emissions and help avoid a range of adverse health effects associated with ambient $PM_{2.5}$ and ozone levels. In addition, the standards will help reduce exposures to diesel PM exhaust, various gaseous hydrocarbons and air toxics. As described below, the reductions in PM and ozone from the standards are expected to result in significant reductions in premature deaths and other serious human health effects, as well as other important public health and welfare effects.

EPA typically quantifies and monetizes PM- and ozone-related impacts in its regulatory impact analyses (RIAs) when possible. The RIA for the proposal for this rulemaking only quantified benefits from PM; in the current RIA we quantify and monetize the ozone-related health and environmental impacts associated with the final rule. The science underlying the analysis is based on the current ozone criteria document.[182] To estimate the incidence and monetary value of the health outcomes associated with this final rule, we used health impact functions based on published epidemiological studies, and valuation functions derived from the economics literature.[183] Key health endpoints analyzed include premature mortality, hospital and emergency room visits, school absences, and minor restricted activity days. The analytic approach to characterizing uncertainty is consistent with the analysis used in the RIA for the proposed O3 NAAQS.

The benefits modeling is based on peer-reviewed studies of air quality and health and welfare effects associated with improvements in air quality and peer-reviewed studies of the dollar values of those public health and welfare effects. These methods are consistent with benefits analyses performed for the recent analysis of the proposed Ozone NAAQS and the final PM NAAQS analysis.[184, 185] They are described in detail in the RIAs prepared for those rules.

The range of PM benefits associated with the final standards is estimated based on risk reductions estimated using several sources of PM-related mortality effect estimates. In order to provide an indication of the sensitivity of the benefits estimates to alternative assumptions about PM mortality risk reductions, in Chapter 6 of the RIA we present a variety of benefits estimates based on two epidemiological studies (including the ACS study and the Six Cities Study) and the recent PM mortality expert elicitation.[186] EPA intends to ask the Science Advisory Board to provide additional advice as to which scientific studies should be used in future RIAs to estimate the benefits of reductions in PM-related premature mortality.

The range of ozone benefits associated with the final standards is also estimated based on risk reductions estimated using several sources of ozone-related mortality effect estimates. There is considerable uncertainty in the magnitude of the association between ozone and premature mortality. This analysis presents four alternative estimates for the association based upon different functions reported in the scientific literature. We use the National Morbidity, Mortality and Air Pollution Study (NMMAPS),[187] which was used as the primary basis for the risk analysis in the ozone Staff Paper [188] and reviewed by the Clean Air Science Advisory Committee (CASAC).[189] We also use three studies that synthesize ozone mortality data across a large number of individual studies.[190, 191, 192] Note that there are uncertainties within each study that are not fully captured by this range of estimates.

Recognizing that additional research is necessary to clarify the underlying mechanisms causing these effects, we also consider the possibility that the observed associations between ozone and mortality may not be causal in nature. EPA has requested advice from the National Academy of Sciences on how best to quantify uncertainty in the relationship between ozone exposure and premature mortality in the context of quantifying benefits associated with ozone control strategies.

The range of total ozone- and PM-related benefits associated with the final standards is presented in Table VI–1. We present total benefits based on the PM-and ozone-related premature mortality function used. The benefits ranges therefore reflect the addition of each estimate of ozone-related premature mortality (each with its own row in Table VI–1) to estimates of PM-related premature mortality, derived from either the epidemiological literature or the expert elicitation. The estimates in Table VI–1, and all monetized benefits presented in this section, are in year 2006 dollars.

182 U.S. Environmental Protection Agency (2006) Air quality criteria for ozone and related photochemical oxidants (second external review draft) Research Triangle Park, NC: National Center for Environmental Assessment; report no. EPA/600R–05/004aB–cB, 3v. Available: *http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=137307* [March 2006]

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

184 U.S. Environmental Protection Agency. August 2007. Proposed Regulatory Impact Analysis (RIA) for the Proposed National Ambient Air Quality Standards for Ozone. Prepared by: Office of Air and Radiation. Available at *http://www.epa.gov/ttn/ecas/ria.html#ria2007*.

185 U.S. Environmental Protection Agency. October 2006. Final Regulatory Impact Analysis (RIA) for the Proposed National Ambient Air Quality Standards for Particulate Matter. Prepared by: Office of Air and Radiation. Available at *http://www.epa.gov/ttn/ecas/ria.html*.

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TABLE VI–1.—ESTIMATED 2030 MONETIZED PM- AND OZONE-RELATED HEALTH BENEFITS OF THE FINAL LOCOMOTIVE AND MARINE ENGINE STANDARDS [a]

Premature ozone mortality function or assumption	Reference	Mean total benefits (billions, 2006$, 3% discount rate) [c d]	Mean total benefits (billions, 2006$, 7% discount rate) [c d]
2030 Total Ozone and PM Benefits—PM Mortality Derived From American Cancer Society Analysis [a]			
NMMAPS	Bell et al., 2004	$9.7	$8.9.
Meta-analysis	Bell et al., 2005	$11	$9.8.
	Ito et al., 2005	$11	$10.
	Levy et al., 2005	$11	$10.
Assumption that association is not causal		$9.2	$8.4.
2030 Total Ozone and PM Benefits—PM Mortality Derived From Expert Elicitation [b]			
NMMAPS	Bell et al., 2004	$5.2 to $37	$4.8 to $34.
Meta-analysis	Bell et al., 2005	$6.2 to $38	$5.8 to $35.
	Ito et al., 2005	$6.7 to $39	$6.3 to $35.
	Levy et al., 2005	$6.7 to $39	$6.4 to $35.
Assumption that association is not causal		$4.7 to $37	$4.4 to $33.

Notes:

[a] Total includes ozone and $PM_{2.5}$ benefits. Range was developed by adding the estimate from the ozone premature mortality function to the estimate of $PM_{2.5}$-related premature mortality derived from the ACS study (Pope et al., 2002).

[b] Total includes ozone and $PM_{2.5}$ benefits. Range was developed by adding the estimate from the ozone premature mortality function to both the lower and upper ends of the range of the $PM_{2.5}$ premature mortality functions characterized in the expert elicitation. The effect estimates of five of the twelve experts included in the elicitation panel fall within the empirically-derived range provided by the ACS and Six-Cities studies. One of the experts fall below this range and six of the experts are above this range. Although the overall range across experts is summarized in this table, the full uncertainty in the estimates is reflected by the results for the full set of 12 experts. The twelve experts' judgments as to the likely mean effect estimate are not evenly distributed across the range illustrated by arraying the highest and lowest expert means.

[c] Note that total benefits presented here do not include a number of unquantified benefits categories. A detailed listing of unquantified health and welfare effects is provided in Table VI–6.

[d] Results reflect the use of both a 3 and 7 percent discount rate, as recommended by EPA's Guidelines for Preparing Economic Analyses and OMB Circular A–4. Results are rounded to two significant digits for ease of presentation and computation.

(1) Quantified Human Health and Environmental Effects of the Final Standards

In this section we discuss the ozone and $PM_{2.5}$ health and environmental impacts of the final standards. We discuss how these impacts are monetized in the next section. It should be noted that the emission control scenarios used in the air quality and benefits modeling are slightly different than the final emission control program. The differences reflect further refinements of the regulatory program since we performed the air quality modeling for this rule. Emissions and air quality modeling decisions are made early in the analytical process. Chapter 3 of the RIA describes the changes in the inputs and resulting emission inventories between the preliminary assumptions used for the air quality modeling and the final emission control scenario.

Estimated Ozone and PM Impacts

To model the ozone and PM air quality benefits of this rule we used the Community Multiscale Air Quality (CMAQ) model. CMAQ simulates the numerous physical and chemical processes involved in the formation, transport, and deposition of particulate matter. This model is commonly used in regional applications to estimate the ozone and PM reductions expected to occur from a given set of emissions controls. The meteorological data input into CMAQ are developed by a separate model, the Penn State University / National Center for Atmospheric Research Mesoscale Model, known as MM5. The modeling domain covers the entire 48-State U.S., as modeled in proposed ozone NAAQS analysis.[193] The grid resolution for the modeling domain was 12 x 12 km.

While this rule will reduce ozone levels generally and provide national ozone-related health benefits, this is not always the case at the local level. Due to the complex photochemistry of ozone production, reductions in NO_X emissions lead to both the formation and destruction of ozone, depending on the relative quantities of NO_X, VOC, and ozone catalysts such as the OH and HO^2 radicals. In areas dominated by fresh emissions of NO_X, ozone catalysts are removed via the production of nitric acid which slows the ozone formation rate. Because NO_X is generally depleted more rapidly than VOC, this effect is usually short-lived and the emitted NO_X can lead to ozone formation later and further downwind. The terms ''NO_X disbenefits'' or ''ozone disbenefits'' refer to the ozone increases that can result from NO_X emissions reductions in these localized areas. According to the North American Research Strategy for Tropospheric Ozone (NARSTO) Ozone Assessment, these disbenefits are generally limited to small regions within specific urban cores and are surrounded by larger regions in which NO_X control is beneficial.[194] For this analysis, we observed two urban areas that, to some degree, experience ozone disbenefits: Southern California and Chicago.

Marginal changes in ozone in these areas are much more dependent upon baseline air quality conditions than PM due to nonlinearities present in the chemistry of ozone formation. A marginal decrease in NO_X emissions modeled on its own in these areas, as

[193] See the Regulatory Impact Analysis for the Proposed Ozone NAAQS (EPA–452/R–07–008, July 2007). This document is available at *http://www.epa.gov/ttn/ecas/ria.html#ria2007.*

[194] The NARSTO Assessment Document synthesizes the scientific understanding of ozone pollution, giving special consideration to behavior on expanded scales over the North American continent, encompassing Canada, the United States, and Mexico. Successive drafts of this Assessment Document experienced progressive stages of review by its authors and by outside peers, and transcripts were recorded containing the review comments and the corresponding actions. This included an external review by the NRC, the comments of which were addressed and incorporated in the final draft. NARSTO, 2000. An Assessment of Tropospheric Ozone Pollution—A North American Perspective. NARSTO Management Office (Envair), Pasco, Washington. *http://narsto.org/*

was done for this analysis, may yield a very different ambient ozone concentration than if it were modeled in combination with other planned or future controls. For example, recent California SIP modeling indicates that with a combined program of national and local controls, California can reach ozone attainment by 2024 through a mixture of substantial NO_X (and VOC) reductions.[195] In areas prone to ozone disbenefits, our ability to draw conclusions based on air quality modeling conducted for the final rule is limited because the yet-to-occur emission reductions in these areas are not accounted for in our analytical approach. Within these regions, it is expected that the additional NO_X reductions from SIP-based controls would lead to fewer ozone disbenefits from the marginal changes modeled here. More detailed information about the air quality modeling conducted for this analysis is included in the air quality modeling technical support document (TSD), which is located in the docket for this rule.

The modeled ambient air quality data serves as an input to the Environmental Benefits Mapping and Analysis Program (BenMAP).[196] BenMAP is a computer program developed by EPA that integrates a number of the modeling elements used in previous Regulatory Impact Analyses (e.g., interpolation functions, population projections, health impact functions, valuation functions, analysis and pooling methods) to translate modeled air concentration estimates into health effects incidence estimates and monetized benefits estimates.

The addition of ozone mortality to our health impacts analysis has led to an increased focus on the issue of ozone disbenefits for two related reasons: (1) The monetized value of ozone-related benefits, in terms of ozone's contribution to total rule-related benefits, has increased due to the inclusion of ozone mortality; and (2) The overall ozone impacts of NO_X reductions in certain geographic regions of the U.S., when modeled on the margin, may be negative.

Figure 1 shows the diurnal pattern of ozone concentrations in the 2030 baseline and post-control scenarios for a grid cell in Orange County, CA during July. From this figure it is clear that the disbenefits (points when the control case ozone levels are higher than the baseline) are occurring primarily during nighttime hours when ozone is generally low.

This diurnal pattern means that the extent of the disbenefits is not as large as one might have thought. Our conversion from using a 24-hour metric to using the maximum 8-hour average metric in the ozone mortality studies (see page 6–4 and the health impacts section) excludes the nighttime hours when NO_X-related disbenefits are most likely to occur.

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[195] SCAQMD (2007). Final 2007 Air Quality Management Plan. Available at: *http://www.aqmd.gov/aqmp(07aqmp/index.html*. Accessed November 8, 2007.

[196] Information on BenMAP, including downloads of the software, can be found at *http://www.epa.gov/air/benmap*.

Figure 2: July 2030 time-series of CMAQ base and control modeling for Orange County, CA

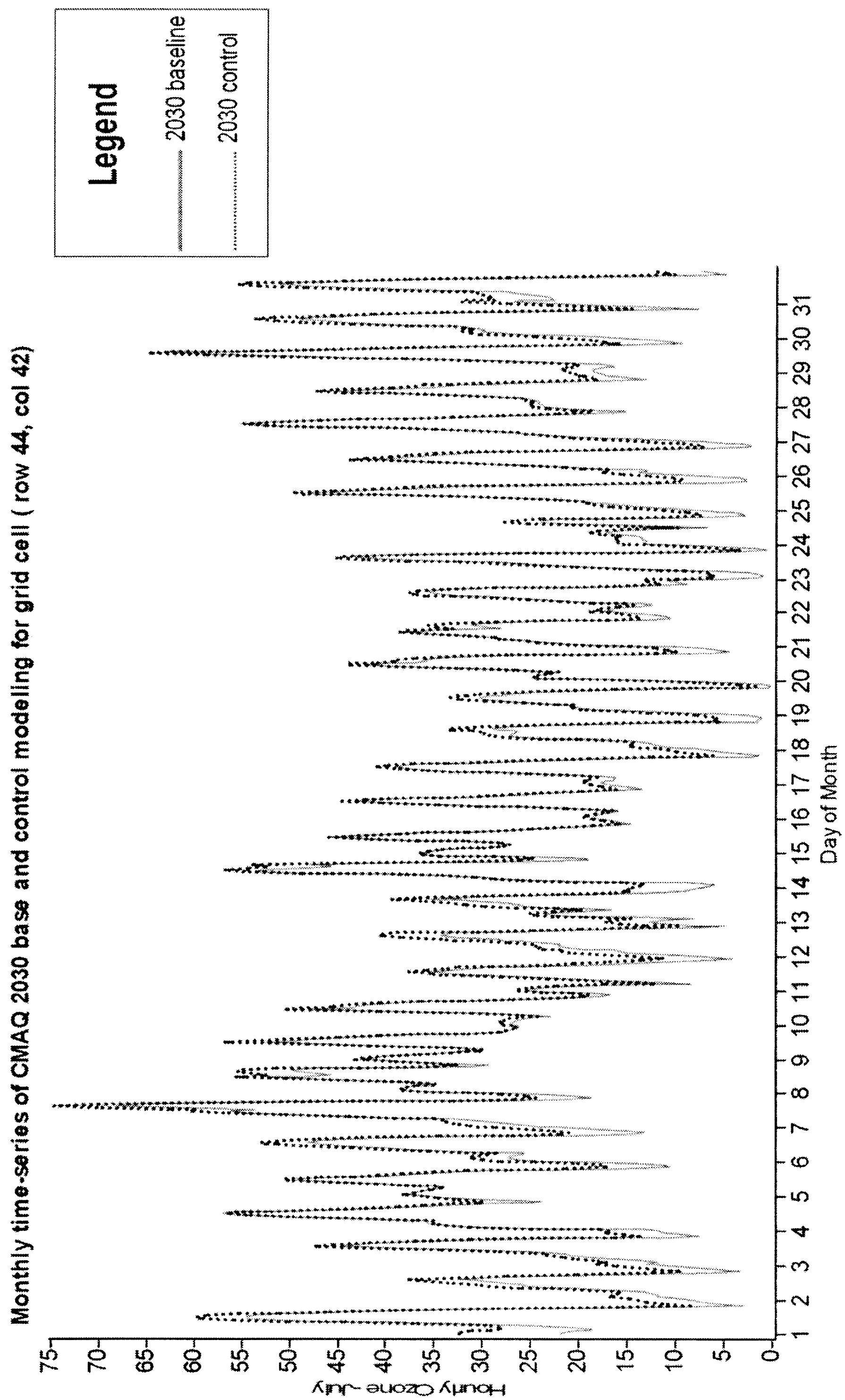

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Table VI–2 presents the estimates of ozone- and PM-related health impacts for the years 2020 and 2030, which are based on the modeled air quality changes between a baseline, pre-control scenario and a post-control scenario reflecting the final emission control strategy.

The use of two sources of PM mortality reflects two different sources of information about the impact of reductions in PM on reduction in the risk of premature death, including both the published epidemiology literature and an expert elicitation study conducted by EPA in 2006. In 2030, based on the estimate provided by the ACS study, we estimate that PM-related emission reductions related to the final rule will result in 1,100 fewer premature fatalities annually. The number of premature mortalities avoided increases to 2,600 when based on the Six Cities study. When the range of expert opinion is used, we estimate between 500 and 4,900 fewer premature mortalities in 2030. We also estimate 680 fewer cases of chronic bronchitis, 2,500 fewer non-fatal heart attacks, 870 fewer hospitalizations (for respiratory and cardiovascular disease combined), 720,000 fewer days of restricted activity due to respiratory illness and approximately 120,000 fewer work-loss days. This analysis projects substantial health improvements for children from reduced upper and lower respiratory illness, acute bronchitis, and asthma attacks. These results are based on an assumed cutpoint in the long-term mortality concentration-response functions at 10 μg/m³, and an assumed cutpoint in the short-term morbidity concentration-response functions at 10 μg/m³. The impact using four alternative cutpoints (10 μg/m³, 7.5 μg/m³, 12 μg/m³, and 14 μg/m³) has on $PM_{2.5}$-related mortality incidence estimation is presented in Chapter 6 of the RIA.

For ozone, we estimate a range of between 54–250 fewer premature mortalities as a result of the final rule in 2030, assuming that there is a causal relationship between ozone exposure and mortality. We also estimate that by 2030, the final rule will result in over 500 avoided respiratory hospital admissions and emergency room visits, 290,000 fewer days of restricted activity due to respiratory illness, and 110,000 school loss days avoided.

TABLE VI–2.—ESTIMATED REDUCTION IN INCIDENCE OF ADVERSE HEALTH EFFECTS RELATED TO THE FINAL LOCOMOTIVE AND MARINE ENGINE STANDARDS [a]

		2020	2030
Health Effect		Mean Incidence Reduction (5th–95th percentile)	
PM-Related Endpoints			
Premature Mortality—Derived from Epidemiology Literature.	Adult, age 30+—ACS cohort study (Pope et al., 2002).	490 (190–790)	1,100 (440–1,800)
	Adult, age 25+—Six-Cities study (Laden et al., 2006).	1,100 (610–1,600)	2,600 (1,400–3,700)
	Infant, age <1 year—Woodruff et al. 1997.	1 (1–2)	2 (1–3)
Premature Mortality—Derived from Expert Elicitation [b].	Adult, age 25+—Lower Bound (Expert K).	220 (0–1,100)	500 (0–2,400)
	Adult, age 25+—Upper Bound (Expert E).	2,200 (1,100–3,300)	4,900 (2,500–7,500)
Chronic bronchitis (adult, age 26 and over)		310 (56–560)	680 (130–1,200)
Acute myocardial infarction (adults, age 18 and older)		1,000 (550–1,500)	2,500 (1,300–3,600)
Hospital admissions—respiratory (all ages) [c]		120 (58–170)	270 (130–400)
Hospital admissions—cardiovascular (adults, age >18) [d]		240 (150–330)	600 (380–820)
Emergency room visits for asthma (age 18 years and younger)		410 (240–580)	890 (520–1,300)
Acute bronchitis (children, age 8–12)		1,000 (−35–2,100)	2,300 (−77–4,600)
Lower respiratory symptoms (children, age 7–14)		9,200 (4,400–14,000)	20,000 (9,700–31,000)
Upper respiratory symptoms (asthmatic children, age 9–18)		6,700 (2,100–11,000)	15,000 (4,600–25,000)
Asthma exacerbation (asthmatic children, age 6–18)		8,400 (920–24,000)	19,000 (2,000–53,000)
Work loss days (adults, age 18–65)		59,000 (51,000–67,000)	120,000 (110,000–140,000)
Minor restricted-activity days (adults, age 18–65)		350,000 (290,000–400,000)	720,000 (610,000–830,000)
Ozone-Related Endpoints			
Premature Mortality, All ages—Derived from NMMAPS.	Bell et al., 2004	13 (−22–49)	54 (−43–150)
Premature Mortality, All ages—Derived from Meta-analyses.	Bell et al., 2005	44 (−47–140)	180 (−69–420)
	Ito et al., 2005	60 (−34–150)	240 (−14–500)
	Levy et al., 2005	62 (−14–140)	250 (44–450)
Premature Mortality—Assumption that association between ozone and mortality is not causal.		0	0
Hospital admissions—respiratory causes (children, under 2; adult, 65 and older) [e].		14 (−150–170)	260 (−350–890)
Emergency room visit for asthma (all ages)		69 (−89–270)	250 (−190–830)
Minor restricted activity days (adults, age 18–65)		84,000 (43,000–120,000)	290,000 (150,000–430,000)

School absence days	33,000 (−17,000–77,000)	110,000 (−15,000–240,000)

Notes:

([a]) Incidence is rounded to two significant digits. PM and ozone estimates represent impacts from the final standards nationwide.

([b]) Based on effect estimates derived from the full-scale expert elicitation assessing the uncertainty in the concentration-response function for PM-related premature mortality (IEc, 2006).[197]

The effect estimates of five of the twelve experts included in the elicitation panel fall within the empirically-derived range provided by the ACS and Six-Cities studies. One of the experts fall below this range and six of the experts are above this range. Although the overall range across experts is summarized in this table, the full uncertainty in the estimates is reflected by the results for the full set of 12 experts. The twelve experts' judgments as to the likely mean effect estimate are not evenly distributed across the range illustrated by arraying the highest and lowest expert means.

([c]) Respiratory hospital admissions for PM include admissions for chronic obstructive pulmonary disease (COPD), pneumonia, and asthma.

([d]) Cardiovascular hospital admissions for PM include total cardiovascular and subcategories for ischemic heart disease, dysrhythmias, and heart failure.

([e]) Respiratory hospital admissions for ozone include admissions for all respiratory causes and subcategories for COPD and pneumonia.

(2) Monetized Benefits

Table VI–3 presents the estimated monetary value of reductions in the incidence of health and welfare effects. Tables VI–4 and VI–5 present the total annual PM- and ozone-related health benefits, which are estimated to be between $9.2 and $11 billion in 2030, assuming a 3 percent discount rate, or between $8.4 and $10 billion, assuming a 7 percent discount rate, using the ACS-derived estimate of PM-related premature mortality (Pope et al., 2002) and the range of ozone-related premature mortality studies derived from the epidemiological literature. The range of benefits expands to between $4.7 and $39 billion, assuming a 3 percent discount rate, when the estimate includes the opinions of outside experts on PM and the risk of premature death, or between $4.4 and $35 billion, assuming a 7 percent discount rate. All monetized estimates are stated in 2006$. These estimates account for growth in real gross domestic product (GDP) per capita between the present and the years 2020 and 2030. As the tables indicate, total benefits are driven primarily by the reduction in premature fatalities each year.

The above estimates of monetized benefits include only one example of non-health related benefits. Changes in the ambient level of $PM_{2.5}$ are known to affect the level of visibility in much of the U.S. Individuals value visibility both in the places they live and work, in the places they travel to for recreational purposes, and at sites of unique public value, such as at National Parks. For the final standards, we present the recreational visibility benefits of improvements in visibility at 86 Class I areas located throughout California, the Southwest, and the Southeast. These estimated benefits are approximately $170 million in 2020 and $400 million in 2030, as shown in Table VI–3.

Table VI–3, VI–4 and VI–5 do not include those additional health and environmental benefits of the rule that we were unable to quantify or monetize. These effects are additive to the estimate of total benefits, and are related to two primary sources. First, there are many human health and welfare effects associated with PM, ozone, and toxic air pollutant reductions that remain unquantified because of current limitations in the methods or available data. A full appreciation of the overall economic consequences of the final standards requires consideration of all benefits and costs projected to result from the new standards, not just those benefits and costs which could be expressed here in dollar terms. A list of the benefit categories that could not be quantified or monetized in our benefit estimates are provided in Table VI–6.

TABLE VI–3.—ESTIMATED MONETARY VALUE IN REDUCTIONS IN INCIDENCE OF HEALTH AND WELFARE EFFECTS

[In millions of 2006$] [a b]

		2020	2030
$PM_{2.5}$-Related Health Effect		Estimated Mean Value of Reductions (5th and 95th percentile)	
Premature Mortality—Derived from Epidemiology Studies [c d].	Adult, age 30+—ACS study (Pope et al., 2002)		
	3% discount rate	$3,400 ($810–$7,000)	$8,100 ($1,900–$16,000)
	7% discount rate	$3,100 ($730–$6,300)	$7,300 ($1,700–$15,000)
	Adult, age 25+—Six-cities study (Laden et al., 2006)		
	3% discount rate	$7,800 ($2,200–$15,000)	$18,000 ($5,100–$35,000)
	7% discount rate	$7,000 ($1,900–$13,000)	$17,000 ($4,600–$32,000)
	Infant Mortality, <1 year—(Woodruff et al. 1997)		
	3% discount rate	$7 ($2–$14)	$13 ($3.5–$26)
	7% discount rate	$7 ($2–$13)	$12 ($3.1–$23)
Premature mortality—Derived from Expert Elicitation [c d e].	Adult, age 25+—Lower bound (Expert K)		
	3% discount rate	$1,500 ($0–$7,700)	$3,600 ($0–$18,000)
	7% discount rate	$1,400 ($0–7,000)	$3,200 ($0–$16,000)
	Adult, age 25+—Upper bound (Expert E)		
	3% discount rate	$15,000 ($4,100–$30,000)	$36,000 ($9,500–$70,000)

[197] Industrial Economics, Incorporated (IEc). 2006. Expanded Expert Judgment Assessment of the Concentration-Response Relationship Between $PM_{2.5}$ Exposure and Mortality. Peer Review Draft. Prepared for: Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC. August.

	7% discount rate	$14,000 ($3,700–$27,000)	$32,000 ($8,600–$63,000)
Chronic bronchitis (adults, 26 and over)		$150 ($12–$500)	$340 ($28–$1,100)
Non-fatal acute myocardial infarctions:			
3% discount rate		$110 ($34–$230)	$260 ($74–$550)
7% discount rate		$110 ($31–$230)	$250 ($69–$540)
Hospital admissions for respiratory causes		$2.1 ($1.0–$3.2)	$4.9 ($2.4–$7.3)
Hospital admissions for cardiovascular causes		$6.7 ($4.2–$9.2)	$17 ($11–$23)
Emergency room visits for asthma		$0.15 ($0.08–$0.23)	$0.33 ($0.18–$0.49)
Acute bronchitis (children, age 8–12)		$0.08 ($0–$0.2)	$0.17 ($0–$0.42)
Lower respiratory symptoms (children, 7–14)		$0.18 ($0.07–$0.33)	$0.40 ($0.15–$0.73)
Upper respiratory symptoms (asthma, 9–11)		$0.21 ($0.06–$0.46)	$0.46 ($0.13–$1.0)
Asthma exacerbations		$0.45 ($0.05–$1.3)	$1.0 ($0.11–$2.9)
Work loss days		$8.9 ($7.7–$10)	$18 ($16–$21)
Minor restricted-activity days (MRADs)		$22 ($13–$32)	$46 ($27–$66)
Recreational Visibility, 86 Class I areas		$170 (na)[f]	$400 (na)
Ozone-related Health Effect			
Premature Mortality, All ages—Derived from NMMAPS.	Bell et al., 2004	$100 (−$170–$420)	$440 (−$340–$1,400)
Premature Mortality, All ages—Derived from Meta-analyses.	Bell et al., 2005	$340 (−$360–$1,200)	$1,400 (−$550–$3,900)
	Ito et al., 2005	$460 (−$260–$1,400)	$1,900 (−$120–$4,700)
	Levy et al., 2005	$480 (−$110–$1,300)	$2,000 ($280–$4,400)
Premature Mortality—Assumption that association between ozone and mortality is not causal.		$0	$0
Hospital admissions—Respiratory causes (children, under 2; adult, 65 and older).		−$0.54 (−$4.6–$3.3)	$2.7 (−$11–$17)
Emergency room visit for asthma (all ages)		$0.03 (−$0.03–$0.1)	$0.09 (−$0.07–$0.30)
Minor restricted activity days (adults, age 18–65)		$2.5 (−$4.0–$9.9)	$8.8 (−$7.8–$28)
School absence days		$2.9 (−$1.5–$6.8)	$11 (−$1.3–$21)
Worker Productivity		$0.53 (na)[f]	$2.9 (na)[f]

NOTES:

([a]) Monetary benefits are rounded to two significant digits for ease of presentation and computation. PM and ozone benefits are nationwide.

([b]) Monetary benefits adjusted to account for growth in real GDP per capita between 1990 and the analysis year (2020 or 2030)

([c]) Valuation assumes discounting over the SAB recommended 20 year segmented lag structure. Results reflect the use of 3 percent and 7 percent discount rates consistent with EPA and OMB guidelines for preparing economic analyses (EPA, 2000; OMB, 2003).

([d]) The valuation of adult premature mortality, derived either from the epidemiology literature or the expert elicitation, is not additive. Rather, the valuations represent a range of possible mortality benefits.

([e]) Based on effect estimates derived from the full-scale expert elicitation assessing the uncertainty in the concentration-response function for PM-related premature mortality (IEc, 2006).[198] The effect estimates of five of the twelve experts included in the elicitation panel fall within the empirically-derived range provided by the ACS and Six-Cities studies. One of the experts fall below this range and six of the experts are above this range. Although the overall range across experts is summarized in this table, the full uncertainty in the estimates is reflected by the results for the full set of 12 experts. The twelve experts' judgments as to the likely mean effect estimate are not evenly distributed across the range illustrated by arraying the highest and lowest expert means.

([f]) We are unable at this time to characterize the uncertainty in the estimate of benefits of worker productivity and improvements in visibility at Class I areas. As such, we treat these benefits as fixed and add them to all percentiles of the health benefits distribution.

TABLE VI–4.—TOTAL MONETIZED BENEFITS OF THE FINAL LOCOMOTIVE AND MARINE ENGINE RULE—3% DISCOUNT RATE

Total Ozone and PM Benefits (Billions, 2006$)—PM Mortality Derived From the ACS Study					
2020			2030		
Ozone mortality function	Reference	Mean total benefits	Ozone mortality function	Reference	Mean total benefits
NMMAPS	Bell et al., 2004	$4.0	NMMAPS	Bell et al., 2004	$9.7
Meta-analysis	Bell et al., 2005	$4.2	Meta-analysis	Bell et al., 2005	$11
	Ito et al., 2005	$4.4		Ito et al., 2005	$11
	Levy et al., 2005	$4.4		Levy et al., 2005	$11
Assumption that association is not causal		$3.9	Assumption that association is not causal		$9.2

[198] Industrial Economics, Incorporated (IEc). 2006. Expanded Expert Judgment Assessment of the Concentration-Response Relationship between $PM_{2.5}$ Exposure and Mortality. Peer Review Draft. Prepared for: Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC. August.

Total Ozone and PM Benefits (Billions, 2006$)—PM Mortality Derived From Expert Elicitation (Lowest and Highest Estimate)

2020			2030		
Ozone mortality function	Reference	Mean total benefits	Ozone mortality function	Reference	Mean total benefits
NMMAPS	Bell et al., 2004	$2.1 to $16	NMMAPS	Bell et al., 2004	$5.2 to $37
Meta-analysis	Bell et al., 2005	$2.4 to $16	Meta-analysis	Bell et al., 2005	$6.2 to $38
	Ito et al., 2005	$2.5 to $16		Ito et al., 2005	$6.7 to $39
	Levy et al., 2005	$2.5 to $16		Levy et al., 2005	$6.7 to $39
Assumption that association is not causal		$2.0 to $16	Assumption that association is not causal		$4.7 to $37

TABLE VI–5.—TOTAL MONETIZED BENEFITS OF THE FINAL LOCOMOTIVE AND MARINE ENGINE RULE—7% DISCOUNT RATE

Total Ozone and PM Benefits (Billions, 2006$)—PM Mortality Derived From Epidemiology Studies (ACS and Six Cities)

2020			2030		
Ozone mortality function	Reference	Mean total benefits	Ozone mortality function	Reference	Mean total benefits
NMMAPS	Bell et al., 2004	$3.7	NMMAPS	Bell et al., 2004	$8.9
Meta-analysis	Bell et al., 2005	$3.9	Meta-analysis	Bell et al., 2005	9.8
	Ito et al., 2005	$4.0		Ito et al., 2005	$10
	Levy et al., 2005	$4.0		Levy et al., 2005	$10
Assumption that association is not causal		$3.6	Assumption that association is not causal		$8.4

Total Ozone and PM Benefits (Billions, 2006$)—PM Mortality Derived From Expert Elicitation (Lowest and Highest Estimate)

2020			2030		
Ozone mortality function	Reference	Mean total benefits	Ozone mortality function	Reference	Mean total benefits
NMMAPS	Bell et al., 2004	$2.0 to $14	NMMAPS	Bell et al., 2004	$4.8 to $34
Meta-analysis	Bell et al., 2005	$2.2 to $15	Meta-analysis	Bell et al., 2005	$5.8 to $35
	Ito et al., 2005	$2.3 to $15		Ito et al., 2005	$6.3 to $35
	Levy et al., 2005	$2.3 to $15		Levy et al., 2005	$6.4 to $35
Assumption that association is not causal		$1.9 to $14	Assumption that association is not causal		$4.4 to $33

TABLE VI–6.—UNQUANTIFIED AND NON-MONETIZED POTENTIAL EFFECTS OF THE FINAL LOCOMOTIVE AND MARINE ENGINE STANDARDS

Pollutant/Effects	Effects Not Included in Analysis—Changes in:
Ozone Health [a]	Chronic respiratory damage [b]
	Premature aging of the lungs [b]
	Non-asthma respiratory emergency room visits
	Exposure to UVb (+/−) [e]
Ozone Welfare	Yields for
	—commercial forests
	—some fruits and vegetables
	—non-commercial crops
	Damage to urban ornamental plants
	Impacts on recreational demand from damaged forest aesthetics
	Ecosystem functions
	Exposure to UVb (+/−) [e]
PM Health [c]	Premature mortality—short term exposures [d]
	Low birth weight
	Pulmonary function
	Chronic respiratory diseases other than chronic bronchitis
	Non-asthma respiratory emergency room visits
	Exposure to UVb (+/−) [e]
PM Welfare	Residential and recreational visibility in non-Class I areas
	Soiling and materials damage
	Damage to ecosystem functions
	Exposure to UVb (+/−) [e]
Nitrogen and Sulfate Deposition Welfare	Commercial forests due to acidic sulfate and nitrate deposition
	Commercial freshwater fishing due to acidic deposition
	Recreation in terrestrial ecosystems due to acidic deposition
	Existence values for currently healthy ecosystems

TABLE VI–6.—UNQUANTIFIED AND NON-MONETIZED POTENTIAL EFFECTS OF THE FINAL LOCOMOTIVE AND MARINE ENGINE STANDARDS—Continued

Pollutant/Effects	Effects Not Included in Analysis—Changes in:
	Commercial fishing, agriculture, and forests due to nitrogen deposition
	Recreation in estuarine ecosystems due to nitrogen deposition
	Ecosystem functions
	Passive fertilization
CO Health	Behavioral effects
HC/Toxics Health [f]	Cancer (benzene, 1,3-butadiene, formaldehyde, acetaldehyde)
	Anemia (benzene)
	Disruption of production of blood components (benzene)
	Reduction in the number of blood platelets (benzene)
	Excessive bone marrow formation (benzene)
	Depression of lymphocyte counts (benzene)
	Reproductive and developmental effects (1,3-butadiene)
	Irritation of eyes and mucus membranes (formaldehyde)
	Respiratory irritation (formaldehyde)
	Asthma attacks in asthmatics (formaldehyde)
	Asthma-like symptoms in non-asthmatics (formaldehyde)
	Irritation of the eyes, skin, and respiratory tract (acetaldehyde)
	Upper respiratory tract irritation and congestion (acrolein)
HC/Toxics Welfare	Direct toxic effects to animals
	Bioaccumulation in the food chain
	Damage to ecosystem function
	Odor

Notes:

(a) The public health impact of biological responses such as increased airway responsiveness to stimuli, inflammation in the lung, acute inflammation and respiratory cell damage, and increased susceptibility to respiratory infection are likely partially represented by our quantified endpoints.

(b) The public health impact of effects such as chronic respiratory damage and premature aging of the lungs may be partially represented by quantified endpoints such as hospital admissions or premature mortality, but a number of other related health impacts, such as doctor visits and decreased athletic performance, remain unquantified.

(c) In addition to primary economic endpoints, there are a number of biological responses that have been associated with PM health effects including morphological changes and altered host defense mechanisms. The public health impact of these biological responses may be partly represented by our quantified endpoints.

(d) While some of the effects of short-term exposures are likely to be captured in the estimates, there may be premature mortality due to short-term exposure to PM not captured in the cohort studies used in this analysis. However, the PM mortality results derived from the expert elicitation do take into account premature mortality effects of short term exposures.

(e) May result in benefits or disbenefits.

(f) Many of the key hydrocarbons related to this rule are also hazardous air pollutants listed in the Clean Air Act.

(3) What Are the Significant Limitations of the Benefit-Cost Analysis?

Every benefit-cost analysis examining the potential effects of a change in environmental protection requirements is limited to some extent by data gaps, limitations in model capabilities (such as geographic coverage), and uncertainties in the underlying scientific and economic studies used to configure the benefit and cost models. Limitations of the scientific literature often result in the inability to estimate quantitative changes in health and environmental effects, such as potential increases in premature mortality associated with increased exposure to carbon monoxide. Deficiencies in the economics literature often result in the inability to assign economic values even to those health and environmental outcomes which can be quantified. These general uncertainties in the underlying scientific and economics literature, which can lead to valuations that are higher or lower, are discussed in detail in the RIA and its supporting references. Key uncertainties that have a bearing on the results of the benefit-cost analysis of the final standards include the following:

• The exclusion of potentially significant and unquantified benefit categories (such as health, odor, and ecological benefits of reduction in air toxics, ozone, and PM);

• Errors in measurement and projection for variables such as population growth;

• Uncertainties in the estimation of future year emissions inventories and air quality;

• Uncertainty in the estimated relationships of health and welfare effects to changes in pollutant concentrations including the shape of the C–R function, the size of the effect estimates, and the relative toxicity of the many components of the PM mixture;

• Uncertainties in exposure estimation; and

• Uncertainties associated with the effect of potential future actions to limit emissions.

As Table VI–3 indicates, total benefits are driven primarily by the reduction in premature mortalities each year. Some key assumptions underlying the premature mortality estimates include the following, which may also contribute to uncertainty:

• Inhalation of fine particles is causally associated with premature death at concentrations near those experienced by most Americans on a daily basis. Although biological mechanisms for this effect have not yet been completely established, the weight of the available epidemiological, toxicological, and experimental evidence supports an assumption of causality. The impacts of including a probabilistic representation of causality were explored in the expert elicitation-based results of the recently published PM NAAQS RIA. Consistent with that analysis, we discuss the implications of these results in the RIA for the final standards.

• All fine particles, regardless of their chemical composition, are equally potent in causing premature mortality. This is an important assumption, because PM produced via transported precursors emitted from locomotive and marine engines may differ significantly from PM precursors released from electric generating units and other industrial sources. However, no clear scientific grounds exist for supporting differential effects estimates by particle type.

• The C–R function for fine particles is approximately linear within the range of ambient concentrations under consideration (above the assumed threshold of 10 μg/m^3). Thus, the estimates include health benefits from reducing fine particles in areas with varied concentrations of PM, including both regions that may be in attainment with $PM_{2.5}$ standards and those that are at risk of not meeting the standards.

• There is considerable uncertainty in the magnitude of the association between ozone and premature mortality. The range of ozone benefits associated with the final standards is estimated based on the risk of several sources of ozone-related mortality effect estimates. Recognizing that additional research is necessary to clarify the underlying mechanisms causing these effects, we also consider the possibility that the observed associations between ozone and mortality may not be causal in nature. EPA has requested advice from the National Academy of Sciences on how best to quantify uncertainty in the relationship between ozone exposure and premature mortality in the context of quantifying benefits.

Despite these uncertainties, we believe this benefit-cost analysis provides a conservative estimate of the estimated economic benefits of the final standards in future years because of the exclusion of potentially significant benefit categories. Acknowledging benefits omissions and uncertainties, we present a best estimate of the total benefits based on our interpretation of the best available scientific literature and methods supported by EPA's technical peer review panel, the Science Advisory Board's Health Effects Subcommittee (SAB–HES). The National Academies of Science (NRC, 2002) also reviewed EPA's methodology for analyzing the health benefits of measures taken to reduce air pollution. EPA addressed many of these comments in the analysis of the final PM NAAQS.[199 200] The analysis of the final standards incorporates this most recent work to the extent possible.

(4) Benefit-Cost Analysis

In estimating the net benefits of the final standards, the appropriate cost measure is ''social costs.'' Social costs represent the welfare costs of a rule to society. These costs do not consider transfer payments (such as taxes) that are simply redistributions of wealth. Table VI–7 contains the estimates of monetized benefits and estimated social welfare costs for the final rule and each of the final control programs. The annual social welfare costs of all provisions of this final rule are described more fully in Section VII of this preamble.

The results in Table VI–7 suggest that the 2020 monetized benefits of the final standards are greater than the expected social welfare costs. Specifically, the annual benefits of the total program will range between $3.9 to $8.8 billion annually in 2020 using a three percent discount rate, or between $3.6 to $8.0 billion assuming a 7 percent discount rate, compared to estimated social costs of approximately $330 million in that same year. These benefits are expected to increase to between $9.2 and $22 billion annually in 2030 using a three percent discount rate, or between $8.4 and $20 billion assuming a 7 percent discount rate, while the social costs are estimated to be approximately $740 million. Though there are a number of health and environmental effects associated with the final standards that we are unable to quantify or monetize (see Table VI–6), the benefits of the final standards far outweigh the projected costs. When we examine the benefit-to-cost comparison for the rule standards separately, we also find that the benefits of the specific engine standards far outweigh their projected costs.

TABLE VI–7.—SUMMARY OF ANNUAL BENEFITS, COSTS, AND NET BENEFITS OF THE FINAL LOCOMOTIVE AND MARINE ENGINE STANDARDS (MILLIONS, 2006$) [a]

Description	2020 (Millions of 2006 dollars)	2020 (Millions of 2006 dollars)
Estimated Social Costs: [b]		
Locomotive:	$200	$460.
Marine:	$140	$280.
Total Social Costs	$330	$740.
Estimated Health Benefits of the Final Standards: [c d e f]		
Locomotive:		
3 percent discount rate	$2,000 to $4,400	$4,300 to $11,000.
7 percent discount rate	$1,900 to $4,000	$4,000 to $10,000.
Marine:		
3 percent discount rate	$1,900 to $4,400	$4,900 to $11,000.
7 percent discount rate	$1,700 to $4,000	$4,400 to $10,000
Total Benefits:		
3 percent discount rate	$3,900 to $8,800	$9,200 to $22,000.
7 percent discount rate	$3,600 to $8,000	$8,400 to $20,000.
Annual Net Benefits (Total Benefits—Total Costs):		
3 percent discount rate	$3,600 to $8,500	$8,500 to $21,000
7 percent discount rate	$3,300 to $7,700	$7,700 to $19,000

Notes:

[a] All estimates represent annualized benefits and costs anticipated for the years 2020 and 2030. Totals may not sum due to rounding.

[b] The calculation of annual costs does not require amortization of costs over time. Therefore, the estimates of annual cost do not include a discount rate or rate of return assumption (see Chapter 7 of the RIA). In Section V, however, we do use both a 3 percent and 7 percent social discount rate to calculate the net present value of total social costs consistent with EPA and OMB guidelines for preparing economic analyses.

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

[200] U.S. Environmental Protection Agency. October 2006. Final Regulatory Impact Analysis (RIA) for the Proposed National Ambient Air Quality Standards for Particulate Matter. Prepared by: Office of Air and Radiation. Available at *http://www.epa.gov/ttn/ecas/ria.html.*

[201] U.S. Environmental Protection Agency, 2000. Guidelines for Preparing Economic Analyses. *www.yosemite1.epa.gov/ee/epa/eed/hsf/pages/Guideline.html.*

[202] Office of Management and Budget, The Executive Office of the President, 2003. Circular A–4. *http://www.whitehouse.gov/omb/circulars.*

[c] Total includes ozone and $PM_{2.5}$ benefits. Range was developed by adding the estimate from the ozone premature mortality function, including an assumption that the association is not causal, to both estimates of $PM_{2.5}$-related premature mortality derived from the ACS (Pope et al., 2002) and Six-Cities (Laden et al., 2006) studies, respectively.

[d] Annual benefits analysis results reflect the use of a 3 percent and 7 percent discount rate in the valuation of premature mortality and nonfatal myocardial infarctions, consistent with EPA and OMB guidelines for preparing economic analyses (US EPA, 2000 and OMB, 2003).[201 202]

[e] Valuation of premature mortality based on long-term PM exposure assumes discounting over the SAB recommended 20-year segmented lag structure described in the Regulatory Impact Analysis for the Final Clean Air Interstate Rule (March, 2005).

[f] Not all possible benefits or disbenefits are quantified and monetized in this analysis. Potential benefit categories that have not been quantified and monetized are listed in Table VI–6.

VII. Alternative Program Options

The program we are finalizing today represents a broad and comprehensive approach to reducing emissions from locomotive and marine diesel engines. As we developed this final rule, we considered a number of alternatives with regard to the scope and timing of the standards. After carefully evaluating these alternatives, we believe that our new program provides the best opportunity for achieving timely and substantial emission reductions from locomotive and marine diesel engines. Our final program balances a number of key factors: (1) Achieving significant emissions reductions as early as possible, (2) providing appropriate lead time to develop and apply advanced control technologies, and (3) coordinating requirements in this final rule with existing highway and nonroad diesel engine programs. The alternative scenarios described here were constructed to further evaluate each individual aspect of our program, and have enabled us to achieve the appropriate balance between these key factors. This section presents a summary of our analysis of these alternative control scenarios. For a more detailed explanation of our analysis, including a year by year breakout of expected costs and emission reductions, please refer to Chapter 8 of the Regulatory Impact Analysis (RIA) prepared for this final rulemaking.

A. Summary of Alternatives

(1) Alternative 1: Proposed Program From the Notice of Proposed Rulemaking

Alternative 1 examines the differences between the program we proposed and the program we are finalizing in this rulemaking. The proposal consisted of a three-part program. First, it proposed more stringent standards for existing locomotives that would apply when they were remanufactured. These standards would go into effect as soon as a certified remanufacture system became available. Second, we proposed a set of near-term emission standards, referred to as Tier 3, for freshly manufactured locomotives and marine engines that reflected the application of technologies to reduce engine-out PM and NO_X. Third, we proposed longer-term standards, referred to as Tier 4, that utilized high-efficiency catalytic aftertreatment technology enabled by the availability of ULSD. These standards would phase in over time, beginning in 2014. In addition, we proposed eliminating emissions from unnecessary locomotive idling.

The final rule makes a number of important changes to the program originally set out in the proposal which we believe will yield significantly greater overall NO_X and PM reductions, especially in the critical early years of the program. In particular, the adoption of standards for remanufactured marine engines and a 2-year pull-ahead of the Tier 4 NO_X requirements for line-haul locomotives and for 2000–3700 kW marine engines provide greater near-term reductions than the proposal. The final rule also expands the remanufactured locomotive program to include Class II railroads.

As a stand-alone program, through the year 2040 Alternative 1 provides $PM_{2.5}$ reductions of 286,000 tons NPV 3%, or 121,000 tons NPV 7%, and NO_X reductions of 8,140,000 tons NPV 3%, or 3,320,000 tons NPV 7%. The cost of this alternative through 2040 is estimated to be $8,760 million NPV 3%, or $3,900 million NPV 7%. In 2020, this alternative provides monetized health and welfare benefits of $3.3 billion at a 3% discount rate, or $3.0 billion at a 7% discount rate, and $8.8 billion in 2030 at a 3% discount rate, or $8.0 billion at a 7% discount rate. Through 2040 our final program provides additional $PM_{2.5}$ reductions of 22,000 tons NPV 3%, or 13,000 tons NPV 7%, and additional NO_X reductions of 620,000 tons NPV 3%, or 390,000 tons NPV 7%. Through 2040, the additional costs of our final program will be $650 million NPV 3%, or $410 million NPV 7%. The additional $PM_{2.5}$ monetized health and welfare benefits in 2020 of our final program are $0.6 billion at a 3% discount rate, or $0.6 billion at a 7% discount rate, while in 2030 the additional monetized health and welfare benefits total $0.4 billion at a 3% discount rate, or $0.4 billion at a 7% discount rate.

(2) Alternative 2: Exclusion of Remanufacturing Standards

Alternative 2 examines the potential impacts of the locomotive and marine remanufacturing programs by excluding them from the analysis (see sections III.B.(1)(a)(i), III.B.(1)(b), and III.B.(2)(b) of this Preamble for more details on the remanufacturing standards). As a stand-alone program, Alternative 2 provides $PM_{2.5}$ reductions of 240,000 tons NPV 3%, or 96,000 tons NPV 7%, and NO_X reductions of 7,640,000 tons NPV 3%, or 3,030,000 tons NPV 7%, through the year 2040. The cost of this alternative through 2040 is estimated to be $8,080 million NPV 3%, or $3,430 million NPV 7%. In 2020, this alternative provides monetized health and welfare benefits of $2.5 billion at a 3% discount rate, or $2.3 billion at a 7% discount rate, and $8.2 billion in 2030 at a 3% discount rate, or $7.5 billion at a 7% discount rate. Compared to the final program, our analysis shows that by 2040 eliminating the locomotive and marine remanufacture programs lessen $PM_{2.5}$ emission reductions by 68,000 tons NPV 3%, or 38,000 tons NPV 7%, and NO_X emission reductions by nearly 1,120,000 tons NPV 3%, or 680,000 tons NPV 7%. The cost of this alternative, as compared to our final program through 2040, is estimated to be $1,330 million less NPV 3%, or $880 million less NPV 7%. Compared to our final program, eliminating the locomotive and marine remanufacture programs reduce the monetized health and welfare benefits by $1.4 billion at a 3% discount rate, or $1.3 billion at a 7% discount rate in 2020, and $1.0 billion at a 3% discount rate, or $0.9 billion at a 7% discount rate in 2030.

(3) Alternative 3: Elimination of Tier 3

Alternative 3 eliminates the Tier 3 standards, while retaining the Tier 4 standards and the combined marine and locomotive remanufacturing requirements. As a stand-alone program, alternative 3 provides $PM_{2.5}$ reductions of 237,000 tons NPV 3%, or 100,000 tons NPV 7%, and NO_X reductions of 8,360,000 tons NPV 3%, or 3,530,000 tons NPV 7%, through the year 2040. The cost of this alternative through 2040 is estimated to be $9,240 million NPV 3%, or $4,160 million NPV 7%. In 2020, this alternative provides monetized health and welfare benefits of $2.8 billion at a 3% discount rate, or $2.6 billion at a 7% discount rate, and $7.8

billion in 2030 at a 3% discount rate, or $7.1 billion at a 7% discount rate. Comparing this alternative to our final program allows us to consider the value of the Tier 3 standards on their own merits. Specifically, this alternative would lessen $PM_{2.5}$ emissions reductions by nearly 71,000 tons NPV 3%, or 34,000 tons NPV 7%, and NO_X emissions by 400,000 tons NPV 3%, or 180,000 tons NPV 7%. The cost of this alternative, as compared to our final program through 2040, is estimated to be $170 million less at NPV 3%, or $150 million less at NPV 7%. The monetized health and welfare benefits that would be forgone by eliminating Tier 3 are $1.1 billion at a 3% discount rate, or $1.0 billion at a 7% discount rate in 2020, and $1.4 billion at a 3% discount rate, or $1.3 billion at a 7% discount rate in 2030. Although the remanufacturing programs provide substantial benefits in the near-term, as evidenced by the analysis of Alternative 2, it is clear that Tier 3 also plays an important role in providing both near- and long-term emission reductions.

(4) Alternative 4: Tier 4 Exclusively in 2013

Alternative 4 most closely reflects the program described in our Advanced Notice of Proposed Rulemaking, whereby we would set new aftertreatment based emission standards as soon as possible. In this case, we believe the earliest that such standards could logically be started is in 2013 (three months after the introduction of 15 ppm ULSD in this sector). Alternative 4 eliminates our Tier 3 standards along with the locomotive and marine remanufacturing standards, while pulling the Tier 4 standards ahead to 2013 for all portions of the Tier 4 program. We are unable to make an accurate estimate of the cost for such an approach since we do not believe it to be technically feasible at this time. However, we have reported a cost in the summary table reflecting the same cost estimation method we used for our primary case and have denoted unestimated additional costs as 'C'. These additional unestimated costs would include costs for additional engine test cells, engineering staff, and engineering facilities necessary to introduce Tier 4 early. As a stand-alone program, alternative 4 provides $PM_{2.5}$ reductions of 249,000 tons NPV 3%, or 101,000 tons NPV 7%, and NO_X reductions of 8,320,000 tons NPV 3%, or 3,420,000 tons NPV 7% through the year 2040. In 2020, this alternative provides monetized health and welfare benefits of $3.0 billion at a 3% discount rate, or $2.8 billion at a 7% discount rate, and $8.4 billion in 2030 at a 3% discount rate, or $7.6 billion at a 7% discount rate. Through 2040, this alternative, as compared to our final program, would decrease $PM_{2.5}$ reductions by more than 59,000 NPV 3% tons, or 33,000 tons NPV 7%, and NO_X emissions by 440,000 tons NPV 3%, or 290,000 tons NPV 7%. Compared to our final program, the reduction in monetized health and welfare benefits of this alternative would be $0.9 billion at a 3% discount rate, or $0.8 billion at a 7% discount rate in 2020, while in 2030 the reductions in monetized benefits would be $0.8 billion at a 3% discount rate, or $0.8 billion at a 7% discount rate.

B. Summary of Results

A summary of the four alternatives is contained in Table VII–1 and Table VII–2 below. The PM and NO_X emissions reductions from the alternatives described here compare favorably—in terms of cost effectiveness—to other mobile source control programs that have been or will soon be implemented. These alternatives show that each element of our comprehensive program: the locomotive and marine remanufacturing programs, the near-term Tier 3 emission standards, and the long-term Tier 4 emission standards, represent valuable emission control programs on their own. The collective program results in the greatest emission reductions we believe to be possible giving consideration to all of the elements described in this final rule. Overall, our final program will provide very large reductions in PM, NO_X, and toxic compounds in both the near-term and the long-term. These reductions will be achieved in a manner that: (1) Leverages technology developments in other diesel sectors, (2) aligns well with the clean diesel fuel requirements already being implemented, and (3) provides the lead time needed to deal with the significant engineering design workload that is involved.

TABLE VII–1.—SUMMARY OF INVENTORY AND COSTS AT NPV 3% AND 7%

Alternatives	Standards	Estimated $PM_{2.5}$ reductions 2006–2040		Estimated NO_X reductions 2006–2040		Total costs [a] millions 2006–2040	
		NPV 3%	NPV 7%	NPV 3%	NPV 7%	NPV 3%	NPV 7%
Final Rule	• Locomotive Remanufacturing • Marine Remanufacturing, • Tier 3 Near-term program, • Tier 4 Long-term standards	308,000	134,000	8,760,000	3,710,000	$9,410	$4,310
Alternative 1: Proposed Case (NPRM).	• Proposed Locomotive Remanufacturing program,. • Proposed Tier 3 Near-term program, • Proposed Tier 4 Long-term standards	286,000	121,000	8,140,000	3,320,000	8,760	3,900
Alternative 2: Exclusion of Remanufacturing Standards.	• Tier 3 Near-term program, • Tier 4 Long-term standards	240,000	96,000	7,640,000	3,030,000	8,080	3,430
Alternative 3: Elimination of Tier 3.	• Locomotive Remanufacturing, • Marine Remanufacturing, • Tier 4 Long-term standards	237,000	10,000	8,360,000	3,530,000	9,240	4,160
Alternative 4: Tier 4 Exclusively in 2013.	• Tier 4 Long-term standards only in 2013.	249,000	101,000	8,320,000	3,420,000	9,070+C	3950+C

Note: [a] 'C' represents the additional costs necessary to accelerate the introduction of Tier 4 technologies that we are unable to estimate at this time.

TABLE VII–2.—INVENTORY, COST, AND BENEFITS FOR 2020 AND 2030

	$PM_{2.5}$ emissions reductions (tons)		NO_X emissions reductions (tons)		Total costs[a] (millions)		Benefits[b,c] (billions) $PM_{2.5}$ only 3% discount rate		Benefits[b,c] (billions) $PM_{2.5}$ only 7% discount rate	
	2020	2030	2020	2030	2020	2030	2020	2030	2020	2030
Final Rule	14,000	27,000	370,000	790,000	$350	$760	$3.9	$9.2	$3.6	$8.4
Alternative 1: Proposed Case (NPRM)	13,000	26,000	310,000	780,000	300	750	3.3	8.8	3.0	8.0
Alternative 2: Exclusion of Remanufacturing Standards	8,800	24,000	280,000	760,000	290	720	2.5	8.2	2.3	7.5
Alternative 3: Elimination of Tier 3	8,800	21,000	350,000	760,000	350	760	2.8	7.8	2.6	7.1
Alternative 4: Tier 4 Exclusively in 2013	10,000	24,000	350,000	790,000	360	780	3.0	8.4	2.8	7.6

Notes:

[a] 'C' represents the additional costs necessary to accelerate the introduction of Tier 4 technologies that we are unable to estimate at this time.

[b] Note that the range of PM-related benefits reflects the use of an empirically-derived estimate of PM mortality benefits, based on the ACS cohort study (Pope et al., 2002).

[c] Annual benefits analysis results reflect the use of a 3 percent and 7 percent discount rate in the valuation of premature mortality and nonfatal myocardial infarctions, consistent with EPA and OMB guidelines for preparing economic analyses (US EPA, 2000 and OMB, 2003). U.S. Environmental Protection Agency, 2000. Guidelines for Preparing Economic Analyses. *http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html.*

VIII. Public Participation

Many interested parties participated in the rulemaking process that culminates with this final rule. This process provided opportunity for submitting written public comments following the proposal that we published on April 3, 2007 (72 FR 15938). We considered these comments in developing the final rule. In addition, we held public hearings on the proposed rulemaking on May 8 and 10, 2007, and we have considered comments presented at the hearings.

Throughout the rulemaking process, EPA met with stakeholders including representatives from industry, government, environmental organizations, and others. The program we are finalizing today was developed as a collaborative effort with these stakeholders.

We have prepared a detailed Summary and Analysis of Comments document, which describes comments we received on the proposal and our response to each of these comments. The Summary and Analysis of Comments is available in the docket for this rule at the Internet address listed under **ADDRESSES**, as well as on the Office of Transportation and Air Quality Web site (*www.epa.gov/otaq/locomotv.htm* and *www.epa.gov/otaq/marine.htm*). In addition, comments and responses for key issues are included throughout this preamble.

IX. Statutory and Executive Order Reviews

A. Executive Order 12866: Regulatory Planning and Review

Under section 3(f)(1) of Executive Order (EO) 12866 (58 FR 51735, October 4, 1993), this action is an ''economically significant regulatory action'' because it is likely to have an annual effect on the economy of $100 million or more. Accordingly, EPA submitted this action to the Office of Management and Budget (OMB) for review under EO 12866, and any changes made by EPA after submission to OMB have been documented in the docket for this action.

In addition, EPA prepared an analysis of the potential costs and benefits associated with this action. This analysis is contained in the final Regulatory Impact Analysis that was prepared for this rulemaking, and is available in the docket at the docket internet address listed under **ADDRESSES** above.

B. Paperwork Reduction Act

The information collection requirements in this final rule have been submitted for approval to the Office of Management and Budget (OMB) under the *Paperwork Reduction Act,* 44 U.S.C. 3501 *et seq.* EPA may not conduct the information collection requirements in this rule and may not penalize anyone for failing to comply with the information collection requirements in the rule unless they are currently approved by OMB.

EPA plans to collect information to ensure that locomotives and marine diesel engines conform to the regulations throughout their useful lives. Section 208(a) of the Clean Air Act requires that manufacturers provide information the Administrator may reasonably require to determine compliance with the regulations; submission of the information is therefore mandatory. We will consider confidential all information meeting the requirements of Section 208(c) of the Clean Air Act.

The annual public reporting and recordkeeping burden for this collection of information is estimated to be 287 hours per respondent for locomotives, and 149 hours per respondent for marine. The projected number of respondents and annual reporting, recordkeeping, and cost burdens to respondents are as follows:

- Estimated total number of potential respondents: for locomotives—7; for marine—13.
- Estimated total annual burden hours: for locomotives—14,040 (2,010 per respondent); for marine—25,167 (1,940 per respondent).
- Estimated total annual costs: for locomotives—$1.65 million ($315,000 per respondent); for marine—$1.45 million ($112,000 per respondent).

Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information.

An agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for EPA's regulations in 40 CFR are listed in 40 CFR part 9. When this ICR is approved by OMB, EPA will publish a technical amendment to 40 CFR part 9 in the **Federal Register** to display the OMB control number for the approved information collection requirements contained in this final rule.

C. Regulatory Flexibility Act

(1) Overview

The Regulatory Flexibility Act (RFA) generally requires an agency to prepare a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements under the Administrative Procedure Act or any other statute unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small organizations, and small governmental jurisdictions.

For purposes of assessing the impacts of today's rule on small entities, small entity is defined as: (1) A small business as defined by the Small Business Administration's (SBA) regulations at 13 CFR 121.201 (see Table IX–1, below); (2) a small governmental jurisdiction that is a government of a city, county, town, school district or special district with a population of less than 50,000; and (3) a small organization that is any not-for-profit enterprise which is independently owned and operated and is not dominant in its field.

TABLE IX–1.—PRIMARY SBA SMALL BUSINESS CATEGORIES POTENTIALLY AFFECTED BY THIS REGULATION

Industry	NAICS [a] Codes	Defined by SBA as a small business if less than or equal to:[b]
Locomotive:		
Manufacturers, remanufacturers and importers of locomotives and locomotive engines	333618, 336510	1,000 employees.
Railroad owners and operators	482110, 482111	1,500 employees.
	482112	500 employees.
Engine repair and maintenance	488210	$6.5 million annual sales.
Marine:		
Manufacturers of freshly manufactured marine diesel engines	333618	1,000 employees.
Ship and boat building; ship building and repairing	336611, 346611	1,000 employees.
Engine repair and maintenance	811310	$6.5 million annual sales.
Water transportation, freight and passenger	483	500 employees.
Water transportation, freight and passenger—Offshore Marine Services	483	$25.5 million annual sales.
Scenic and Sightseeing Transportation, Water	487210	$6.5 million annual sales.
Navigational Services to Shipping	488330	$6.5 million annual sales.
Commercial Fishing	114	$4.0 million annual sales.
Boat building (watercraft not built in shipyards and typically of the type suitable or intended for personal use).	336612	500 employees.

Notes:
[a] North American Industry Classification System
[b] According to SBA's regulations (13 CFR 121), businesses with no more than the listed number of employees or dollars in annual receipts are considered "small entities" for RFA purposes.

After considering the economic impacts of today's final rule on small entities, I certify that this action will not have a significant economic impact on a substantial number of small entities. The small entities directly regulated by this final rule are shown in Table IX–1 (and are not small governmental jurisdictions or small non-profit organizations). We have determined that about five small entities representing less than one percent of the total number of companies affected will have an estimated impact exceeding three percent of their annual sales revenues. The vast majority of small entities (about several thousand small companies) will have an estimated impact of less than one percent on their annual sales revenues. (An analysis of the impacts of the rule on small entities was performed for the rule, and can be found in the docket for this rulemaking.[203 204])

Although this final rule will not have a significant economic impact on a substantial number of small entities, EPA nonetheless has tried to reduce the impact of this rule on small entities, as described below.

(2) Outreach Efforts and Special Compliance Provisions for Small Entities

In addition to the inputs we sought prior to issuing the proposed rule, we also received additional comments following its publication. First we summarize the pre-proposal outreach, followed by additional comments we received after the proposal was published.

Early on, we sought the input of a number of small entities affected by the rule on potential regulatory flexibility provisions and the needs of these small businesses. For marine diesel engine manufacturers, we had separate meetings with the four small companies in this sector, which are post-manufacture marinizers (companies that purchase a complete or semi-complete engine from an engine manufacturer and modify it for use in the marine environment by changing the engine in ways that may affect emissions). We also met individually with one small commercial vessel builder and a few vessel trade associations whose members include small vessel builders. For locomotive manufacturers and remanufacturers, we met separately with the three small businesses in these sectors, which are all remanufacturers. In addition, we met with a railroad trade association whose members include small railroads. For nearly all meetings, EPA provided each small business with an outreach packet that included

[203] U.S. EPA, Assessment and Standards Division, *Locomotive and Marine Diesel RFA/SBREFA Screening Analysis,* Memorandum from Chester J. France to Alexander Cristofaro of U.S. EPA's Office of Policy, Economics, and Innovation, September 25, 2006.

[204] U.S. EPA, Assessment and Standards Division, *Supplement to Locomotive and Marine Diesel RFA/SBREFA Screening Analysis—Marine Existing Fleet Program Impact Analysis,* Memorandum from Lucie Audette and Bryan Manning to Docket EPA–HQ–OAR–2003–0190, December 12, 2007.

background information on this proposed rulemaking; and a document outlining some flexibility provisions for small businesses that we have implemented in past rulemakings. (This outreach packet and a complete summary of our discussions with small entities can be found in the docket for this rulemaking.) [205]

The primary feedback we received from these small entities pre-proposal was to continue the flexibility provisions that we have provided to small entities in earlier locomotive and marine diesel rulemakings. A number of these provisions are listed below. Therefore, we will largely continue the existing flexibility provisions finalized in the 1998 Locomotive and Locomotive Engines Rule (April 16, 1998; 63 FR 18977); our 1999 Commercial Marine Diesel Engines Rule (December 29, 1999; 64 FR 73299) and our 2002 Recreational Diesel Marine program (November 8, 2002; 67 FR 68304).

In the proposed rule, we requested comment on an alternative program option—a marine existing fleet or remanufacture program (*Alternative 5: Existing Engines*)—and as described earlier in this preamble, we are finalizing a portion of this alternative. Based on oral testimony at the hearings and written comments (from trade associations, small entities, etc.), we are providing flexibilities to vessel operators and/or marine remanufacturers as described below. For a complete description of the flexibilities in this final rule, please refer to the Certification and Compliance Program, section IV.A.(13)—Small Business Provisions.

(a) Transition Flexibilities

(i) Locomotive Sector

Small locomotive remanufacturers are granted a waiver from production-line and in-use testing for up to five calendar years after this program becomes effective.

Class III railroads qualifying as small businesses are exempt from new Tier 0, 1, and 2 remanufacturing requirements for locomotives in their existing fleets. The Certification and Compliance Program section IV.A.(13) provides a discussion on the revisions being made in this program.

Railroads qualifying as small businesses continue being exempt from the in-use testing program.

[205] U.S. EPA, *Summary of Small Business Outreach for Locomotive and Marine Diesel NPRM*, Memorandum to Docket EPA–HQ–OAR–2003–0190 from Bryan Manning, January 18, 2007.

(ii) Marine Sector

Post-manufacture marinizers and small-volume manufacturers (annual worldwide production of fewer than 1,000 engines) are allowed to group all engines into one engine family, based on the worst-case emitter.

Small-volume manufacturers producing engines less than or equal to 600 kW (800 hp) are exempted from production-line and deterioration testing (assigned deterioration factors) for Tier 3 standards.

Post-manufacture marinizers qualifying as small businesses and producing engines less than or equal to 600 kW (800 hp) may delay compliance with the Tier 3 standards by one model year.

Post-manufacture marinizers qualifying as small businesses and producing engines less than or equal to 600 kW (800 hp) may delay compliance with the Not-to-Exceed requirements for Tier 3 standards by up to three model years.

Marine engine dressers (modify base engine without affecting the emission characteristics of the engine) are exempted from certification and compliance requirements.

Post-manufacture marinizers, small-volume manufacturers, and small-volume boat builders (less than 500 employees and annual worldwide production of fewer than 100 boats) have hardship relief provisions—i.e., apply for additional time.

For the marine existing fleet or remanufacture program, vessel operators and marine remanufacturers qualifying as small businesses also have hardship relief provisions allowing them if necessary to apply for additional time to comply with program requirements.

Vessel operators who earn less than $5 million in gross annual sales revenue are exempted from the marine existing fleet or remanufacture program. If at some future date annual gross revenues exceed $5 million, they become subject to the existing fleet program at that point.

(b) Small Entity Compliance Information

In addition to the above flexibilities, EPA is also preparing documentation to help small entities comply with this rule. This documentation will be available on the Office of Transportation and Air Quality Web site. Small entities may also contact our office to obtain copies of this documentation.

D. Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), P.L. 104–4, establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local, and tribal governments and the private sector. Under section 202 of the UMRA, EPA generally must prepare a written statement, including a cost-benefit analysis, for proposed and final rules with ''Federal mandates'' that may result in expenditures to State, local, and tribal governments, in the aggregate, or to the private sector, of $100 million or more in any one year. Before promulgating an EPA rule for which a written statement is needed, section 205 of the UMRA generally requires EPA to identify and consider a reasonable number of regulatory alternatives and adopt the least costly, most cost-effective or least burdensome alternative that achieves the objectives of the rule. The provisions of section 205 do not apply when they are inconsistent with applicable law. Moreover, section 205 allows EPA to adopt an alternative other than the least costly, most cost-effective or least burdensome alternative if the Administrator publishes with the final rule an explanation why that alternative was not adopted. Before EPA establishes any regulatory requirements that may significantly or uniquely affect small governments, including tribal governments, it must have developed under section 203 of the UMRA a small government agency plan. The plan must provide for notifying potentially affected small governments, enabling officials of affected small governments to have meaningful and timely input in the development of EPA regulatory proposals with significant Federal intergovernmental mandates, and informing, educating, and advising small governments on compliance with the regulatory requirements.

This rule contains no federal mandates for state, local, or tribal governments as defined by the provisions of Title II of the UMRA. The rule imposes no enforceable duties on any of these governmental entities. Nothing in the rule would significantly or uniquely affect small governments. EPA has determined that this rule contains federal mandates that may result in expenditures of more than $100 million to the private sector in any single year. Accordingly, EPA has evaluated under section 202 of the UMRA the potential impacts to the private sector. EPA believes that this rule represents the least costly, most cost-effective approach to achieve the statutory requirements of the rule. The costs and benefits associated with this rule are included in the final Regulatory Impact Analysis (RIA), as required by the UMRA. This analysis can be found in chapter 6 of the final RIA. A complete discussion of why the approach being finalized in this action was chosen is located in chapter 8 of the final RIA. EPA has determined that this rule contains no regulatory requirements that might significantly or uniquely affect small governments.

Thus, this rule is not subject to the requirements of sections 202 and 205 of the UMRA.

E. Executive Order 13132 (Federalism)

Executive Order 13132, entitled ''Federalism'' (64 FR 43255, August 10, 1999), requires EPA to develop an accountable process to ensure ''meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications.'' ''Policies that have federalism implications'' is defined in the Executive Order to include regulations that have ''substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government.''

This final rule does not have federalism implications. It will not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government, as specified in Executive Order 13132. Although section 6 of Executive Order 13132 does not apply to this rule, EPA did consult with representatives of various State and local governments in developing this rule. EPA consulted with representatives from the National Association of Clean Air Agencies (NACAA, formerly STAPPA/ALAPCO), the Northeast States for Coordinated Air Use Management (NESCAUM), and the California Air Resources Board (CARB). These organizations and other state organizations submitted comments on the proposed rule. Their comments are available in the rulemaking docket, and are summarized and addressed in the Summary and Analysis of Comments document (which is also available in the rulemaking docket).

In the spirit of Executive Order 13132, and consistent with EPA policy to promote communications between EPA and State and local governments, EPA specifically solicited comment on the proposed rule from State and local officials.

F. Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments)

Executive Order 13175, entitled ''Consultation and Coordination with Indian Tribal Governments'' (65 FR 67249, November 9, 2000), requires EPA to develop an accountable process to ensure ''meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications.'' This final rule does not have tribal implications, as specified in Executive Order 13175. The rule will be implemented at the Federal level and impose compliance costs only on locomotive manufacturers, locomotive engine manufacturers, locomotive operators, locomotive remanufacturers, marine engine manufacturers, and marine vessel manufacturers. Tribal governments will be affected only to the extent they purchase and use the regulated engines and vehicles. Thus, Executive Order 13175 does not apply to this rule.

Although Executive Order 13175 does not apply to this rule, EPA did solicit additional comment on this rule from tribal officials. A comment was received from one tribal government; that comment is available in the rulemaking docket, and is summarized and addressed in the Summary and Analysis of Comments document (which is also available in the rulemaking docket).

G. Executive Order 13045: Protection of Children From Environmental Health and Safety Risks

Executive Order 13045: ''Protection of Children from Environmental Health Risks and Safety Risks'' (62 FR 19885, April 23, 1997) applies to any rule that: (1) Is determined to be ''economically significant'' as defined under Executive Order 12866, and (2) concerns an environmental health or safety risk that EPA has reason to believe may have a disproportionate effect on children. If the regulatory action meets both criteria, the Agency must evaluate the environmental health or safety effects of the planned rule on children, and explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the Agency.

This final rule is subject to the Executive Order because it is an economically significant regulatory action as defined by Executive Order 12866, and we believe that the environmental health or safety risk addressed by this action may have a disproportionate effect on children. Accordingly, we have evaluated the environmental health or safety effects of these risks on children. The results of this evaluation are discussed above in section II of this preamble, and in chapter 2 of the Regulatory Impact Analysis (RIA).

EPA recently conducted an initial screening-level analysis of selected marine port areas and rail yards[206] [207] to begin to understand the populations, including children, that are exposed to DPM emissions from these facilities. This screening-level analysis [208] indicates that at the 47 marine ports and 37 rail yards studied, at least 13 million people, including 3.5 million children live in neighborhoods that are exposed to higher levels of DPM from these facilities than people living further away and will benefit from the controls being finalized in this action.

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

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

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

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

[208] This type of screening-level analysis is an inexact tool and not appropriate for regulatory decision-making; it is useful in beginning to understand potential impacts and for illustrative purposes. Additionally, the emissions inventories used as inputs into our analysis are not official estimates and they likely underestimate overall emissions because they are not inclusive of all emissions sources at the individual ports in our sample.

EPA has evaluated several regulatory strategies for reductions in emissions from locomotive and marine diesel engines, and we believe that we have selected the most stringent and effective control reasonably feasible at this time (in light of the technology and cost requirements of the Clean Air Act), which will benefit the health of children.

H. Executive Order 13211: Actions That Significantly Affect Energy Supply, Distribution, or Use

Executive Order 13211, ''Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use'' (66 FR 28355 (May 22, 2001)), requires EPA to prepare and submit a Statement of Energy Effects to the Administrator of the Office of Information and Regulatory Affairs, Office of Management and Budget, for certain actions identified as ''significant energy actions.'' Section 4(b) of Executive Order 13211 defines ''significant energy actions'' as ''any action by an agency (normally published in the **Federal Register**) that promulgates or is expected to lead to the promulgation of a final rule or regulation, including notices of inquiry, advance notices of proposed rulemaking, and notices of proposed rulemaking: (1)(i) that is a significant regulatory action under Executive Order 12866 or any successor order, and (ii) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (2) that is designated by the Administrator of the Office of Information and Regulatory Affairs as a significant energy action.'' We have prepared a Statement of Energy Effects for this action as follows.

This rule's potential effects on energy supply, distribution, or use have been analyzed and are discussed in detail in section 5.8 of the RIA. In summary, while we project that this rule would result in an energy effect that exceeds the 4,000 barrel per day threshold noted in E.O. 13211 in or around the year 2022 and thereafter, the program consists of performance-based standards with averaging, banking, and trading provisions that make it likely that our estimated impact is overstated. Further, the fuel consumption estimates upon which we are basing this energy effect analysis, which are discussed in full in sections 5.4 and 5.5 of the RIA, do not reflect the potential fuel savings associated with automatic engine stop/start (AESS) systems or other idle reduction technologies. Such technologies can provide significant fuel savings which could offset our projected estimates of increased fuel consumption. Nonetheless, our projections show that this rule could result in energy usage exceeding the 4,000 barrel per day threshold noted in E.O. 13211.

I. National Technology Transfer Advancement Act

As noted in the proposed rule, Section 12(d) of the National Technology Transfer and Advancement Act of 1995 (''NTTAA''), Public Law No. 104–113, 12(d) (15 U.S.C. 272 note) directs EPA to use voluntary consensus standards in its regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standards bodies. The NTTAA directs EPA to provide Congress, through OMB, explanations when the Agency decides not to use available and applicable voluntary consensus standards.

This rule references technical standards adopted by EPA through previous rulemakings. No new technical standards are established in this rule. The standards referenced in today's rule involve test procedures for measuring engine emissions. These measurement standards include those that were developed by EPA as well as the International Organization for Standardization (ISO) engine testing voluntary consensus standards, adopted in previous rulemakings. These standards have served EPA's emissions control goals well since their implementation and have been well accepted by industry. Therefore, EPA will continue to use the ISO and existing EPA-developed standards referenced in 40 CFR Parts 94 and 1065.

J. Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

Executive Order (EO) 12898 (59 FR 7629 (Feb. 16, 1994)) establishes federal executive policy on environmental justice. Its main provision directs federal agencies, to the greatest extent practicable and permitted by law, to make environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations in the United States.

EPA has determined that this final rule will not have disproportionately high and adverse human health or environmental effects on minority or low-income populations because it increases the level of environmental protection for all affected populations without having any disproportionately high and adverse human health or environmental effects on any population, including any minority or low-income population.

This rulemaking will achieve significant reductions of various emissions from locomotive and marine diesel engines, including NO_X, PM, and air toxics. Exposure to these pollutants raises concerns regarding environmental health for the U.S. population in general including the minority populations and low-income populations that are the focus of the environmental justice executive order.

EPA has evaluated several regulatory strategies for reductions in emissions from locomotive and marine diesel engines, and we believe that we have selected the most stringent and effective control reasonably feasible at this time (in light of the technology and cost requirements of the Clean Air Act).

The emission reductions from the stringent new standards finalized in the locomotive and marine diesel rule will have large beneficial effects on communities in proximity to port, harbor, waterway, railway, and rail yard locations, including low-income and minority communities. In addition to stringent exhaust emission standards for freshly manufactured and remanufactured engines, the final rule includes provisions targeted to further reduce emissions from regulated engines that directly impact low-income and minority communities. The idle reduction provision is one example: ''Even in very efficient railroad operations, locomotive engines spend a substantial amount of time idling, during which they emit harmful pollutants, consume fuel, create noise, and increase maintenance costs. A significant portion of this idling occurs in rail yards, as railcars and locomotives are transferred to build up trains. Many of these rail yards are in urban neighborhoods, close to where people live, work, and go to school'' (from section III.C(1)(c) of this preamble). The final rule includes a mandatory locomotive idle reduction requirement that will begin to take effect as early as 2008. Another example is the emission standards for freshly manufactured switch locomotives. Switch locomotives are major polluters in urban rail yards. These standards are earlier and more stringent than the line-haul locomotive standards, and include incentives for introducing cleaner switchers using Tier

4 nonroad engines. Further examples can be found in averaging, banking, and trading program provisions aimed at ensuring that emissions are not shifted from line-haul locomotives operating in rural areas to rail yards in urban communities.

EPA recently conducted an initial screening-level analysis of selected marine port areas and rail yards [209] [210] to better understand the populations, including minority and low-income, that are exposed to DPM emissions from these facilities. This screening-level analysis [211] indicates that at the 47 marine ports and 37 rail yards studied at least 13 million people, including a high percentage of low-income households, African-Americans, and Hispanics, live in the vicinity of these facilities and are exposed to higher levels of DPM than urban background levels. Thus, these residents will benefit from the controls being finalized in this action. See section II.A and II.B of this preamble and chapter 2 of the RIA for a discussion on the benefits of this rule, including the benefits to minority and low-income communities. Because those living in the vicinity of marine ports and rail yards are more likely to be low-income and minority residents, these populations will receive a significant benefit from this rule.

K. Congressional Review Act

The Congressional Review Act, 5 U.S.C. 801 et seq., as added by the Small Business Regulatory Enforcement Fairness Act of 1996, generally provides that before a rule may take effect, the agency promulgating the rule must submit a rule report, which includes a copy of the rule, to each House of the Congress and to the Comptroller General of the United States. EPA will submit a report containing this rule and other required information to the U.S. Senate, the U.S. House of Representatives, and the Comptroller General of the United States prior to publication of the rule in the **Federal Register**. A Major rule cannot take effect until 60 days after it is published in the **Federal Register**. This action is a ''major rule'' as defined by 5 U.S.C. 804(2). This rule will be effective July 7, 2008.

X. Statutory Provisions and Legal Authority

Statutory authority for the controls in this final rule can be found in sections 213 (which specifically authorizes controls on emissions from nonroad engines and vehicles), 203–209, 216, and 301 of the Clean Air Act (CAA), 42 U.S.C. 7547, 7522, 7523, 7424, 7525, 7541, 7542, 7543, 7550, and 7601.

List of Subjects

40 CFR Part 9

Reporting and recordkeeping requirements.

40 CFR Part 85

Confidential business information, Imports, Labeling, Motor vehicle pollution, Reporting and recordkeeping requirements, Research, Warranties.

40 CFR Part 86

Administrative practice and procedure, Confidential business information, Labeling, Motor vehicle pollution, Reporting and recordkeeping requirements.

40 CFR Part 89

Environmental protection, Administrative practice and procedure, Confidential business information, Imports, Labeling, Motor vehicle pollution, Reporting and recordkeeping requirements, Research, Vessels, Warranties.

40 CFR Part 92

Environmental protection, Administrative practice and procedure, Air pollution control, Confidential business information, Imports, Incorporation by reference, Labeling, Penalties, Railroads, Reporting and recordkeeping requirements, Warranties.

40 CFR Part 94

Environmental protection, Administrative practice and procedure, Air pollution control, Confidential business information, Imports, Incorporation by reference, Labeling, Penalties, Vessels, Reporting and recordkeeping requirements, Warranties.

40 CFR Part 1033

Environmental protection, Administrative practice and procedure, Confidential business information, Incorporation by reference, Labeling, Penalties, Railroads, Reporting and recordkeeping requirements.

40 CFR Part 1039

Environmental protection, Administrative practice and procedure, Air pollution control, Confidential business information, Imports, Incorporation by reference, Labeling, Penalties, Reporting and recordkeeping requirements, Warranties.

40 CFR Part 1042

Environmental protection, Administrative practice and procedure, Air pollution control, Confidential business information, Imports, Incorporation by reference, Labeling, Penalties, Vessels, Reporting and recordkeeping requirements, Warranties.

40 CFR Part 1065

Environmental protection, Administrative practice and procedure, Incorporation by reference, Reporting and recordkeeping requirements, Research.

40 CFR Part 1068

Environmental protection, Administrative practice and procedure, Confidential business information, Imports, Motor vehicle pollution, Penalties, Reporting and recordkeeping requirements, Warranties.

Dated: March 14, 2008.

Stephen L. Johnson,

Administrator.

■ For the reasons set forth in the preamble, chapter I of title 40 of the Code of Federal Regulations is amended as follows:

PART 9—OMB APPROVALS UNDER THE PAPERWORK REDUCTION ACT

■ 1. The authority citation for part 9 continues to read as follows:

Authority: 7 U.S.C. 135 et seq., 136–136y; 15 U.S.C. 2001, 2003, 2005, 2006, 2601–2671; 21 U.S.C. 331j, 346a, 348; 31 U.S.C. 9701; 33 U.S.C. 1251 *et seq.*, 1311, 1313d, 1314, 1318 1321, 1326, 1330, 1342 1344, 1345(d) and (e), 1361; E.O. 11735, 38 FR 21243, 3 CFR, 1971–1975 Comp. p. 973; 42 U.S.C. 241, 242b, 243, 246, 300f, 300g, 300g–1, 300g–2, 300g–3, 300g–4, 300g–5, 300g–6, 300j–1, 300j–2, 300j–3, 300j–4, 300j–9, 1857 *et seq.*, 6901–6992k, 7401–7671q, 7542, 9601–9657, 11023, 11048.

■ 2. Section 9.1 is amended in the table by adding the center headings and the

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

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

[211] This type of screening analysis is an inexact tool and not appropriate for regulatory decision-making; it is useful in beginning to understand potential impacts and for illustrative purposes. Additionally, the emissions inventories used as inputs into our analysis are not official estimates and they likely underestimate overall emissions because they are not inclusive of all emission sources at the individual ports in our sample.

entries under those center headings in numerical order to read as follows:

§ 9.1 OMB approvals under the Paperwork Reduction Act.

* * * * *

40 CFR citation	OMB control No.
* * * *	
Control of Emissions from Locomotives	
1033.825	2060–0287
* * * * *	
Control of Emissions From New and In-use Marine Compression-ignition Engines and Vessels	
042.825	2060–0827
* * * * *	

* * * * *

PART 85—CONTROL OF AIR POLLUTION FROM MOBILE SOURCES

■ 3. The authority citation for part 85 continues to read as follows:

Authority: 42 U.S.C. 7401–7671q.

Subpart Y—[Amended]

■ 4. Section 85.2401 is amended by revising paragraphs (a)(7) and (a)(8) to read as follows:

§ 85.2401 To whom do these requirements apply?

(a) * * *

(7) Locomotives (See 40 CFR parts 92 and 1033);

(8) Marine engines (See 40 CFR parts 91, 94, and 1042 and MARPOL Annex VI, as applicable);

* * * * *

PART 86—CONTROL OF EMISSIONS FROM NEW AND IN-USE HIGHWAY VEHICLES AND ENGINES

■ 5. The authority citation for part 86 continues to read as follows:

Authority: 42 U.S.C. 7401–7671q.

Subpart A—[Amended]

■ 6. Section 86.007–11 is amended by revising paragraph (a)(2) introductory text to read as follows:

§ 86.007–11 Emission standards and supplemental requirements for 2007 and later model year diesel heavy-duty engines and vehicles.

* * * * *

(a) * * *

(2) The standards set forth in paragraph (a)(1) of this section refer to the exhaust emitted over the duty cycle specified in paragraphs (a)(2)(i) through (iii) of this section, where exhaust emissions are measured and calculated as specified in paragraphs (a)(2)(iv) and (v) of this section in accordance with the procedures set forth in subpart N of this part, except as noted in § 86.007–23(c)(2):

* * * * *

■ 7. Section 86.117–96 is amended by revising the first equation in paragraph (d)(2) to read as follows:

§ 86.117–96 Evaporative emission enclosure calibrations.

* * * * *

(d) * * *

(2) * * *

$$M_{HC} = \left(kV_n \times 10^{-4}\right) \times \left(\frac{\left(C_{HC_f} - rC_{CH_3OH_f}\right)P_{B_f}}{T_f} - \frac{\left(C_{HC_i} - rC_{CH_3OH_i}\right)P_{B_i}}{T_i} \right) + \left(M_{HC,out} - M_{HC,in}\right)$$

* * * * *

Subpart N—[Amended]

■ 8. Section 86.1305–2010 is amended by revising paragraph (b) to read as follows:

§ 86.1305–2010 Introduction; structure of subpart.

* * * * *

(b) Use the applicable equipment and procedures for spark-ignition or compression-ignition engines in 40 CFR part 1065 to determine whether engines meet the duty-cycle emission standards in subpart A of this part. Measure the emissions of all regulated pollutants as specified in 40 CFR part 1065. Use the duty cycles and procedures specified in §§ 86.1333–2010, 86.1360–2007, and 86.1362–2007. Adjust emission results from engines using aftertreatment technology with infrequent regeneration events as described in § 86.004–28.

* * * * *

■ 9. Section 86.1333–2010 is amended by adding paragraph (d) to read as follows:

§ 86.1333–2010 Transient test cycle generation.

* * * * *

(d) Determine idle speeds as specified in § 86.1337–2007(a)(9).

■ 10. Section 86.1360–2007 is amended by adding paragraph (b)(3) to read as follows:

§ 86.1360–2007 Supplemental emission test; test cycle and procedures.

* * * * *

(b) * * *

(3) For engines certified using the ramped-modal cycle specified in (86.1362, perform the three discrete test points described in paragraph (b)(2) of this section as follows:

(i) Allow the engine to idle as needed to complete equipment checks following the supplemental emission test described in this section, then operate the engine over the three additional discrete test points.

(ii) Validate the additional discrete test points as a composite test separate from the supplemental emission test, but in the same manner.

(iii) Use the emission data collected during the time interval from 35 to 5 seconds before the end of each mode (excluding transitions) to perform the MAEL calculations in paragraph (f) of this section.

* * * * *

§ 86.1362–2007 [Amended]

■ 11. Section 86.1362–2007 is amended by removing and reserving paragraph (d).

■ 12. A new § 86.1362–2010 is added to read as follows:

§ 86.1362–2010 Steady-state testing with a ramped-modal cycle.

This section describes how to test engines under steady-state conditions. For model years through 2009, manufacturers may use the mode order described in this section or in § 1362–2007. Starting in model year 2010 manufacturers must use the mode order described in this section with the following exception: for model year 2010, manufacturers may continue to use the cycle specified in § 1362–2007 as long as it does not adversely affect the ability to demonstrate compliance with the standards.

(a) Start sampling at the beginning of the first mode and continue sampling until the end of the last mode. Calculate emissions as described in 40 CFR 1065.650 and cycle statistics as described in 40 CFR 1065.514.

(b) Measure emissions by testing the engine on a dynamometer with the following ramped-modal duty cycle to determine whether it meets the applicable steady-state emission standards:

RMC mode	Time in mode (seconds)	Engine speed [1,2]	Torque (percent) [2,3]
1a Steady-state	170	Warm Idle	0
1b Transition	20	Linear Transition	Linear Transition.
2a Steady-state	173	A	100
2b Transition	20	Linear Transition	Linear Transition.
3a Steady-state	219	B	50
3b Transition	20	B	Linear Transition.
4a Steady-state	217	B	75
4b Transition	20	Linear Transition	Linear Transition.
5a Steady-state	103	A	50
5b Transition	20	A	Linear Transition.
6a Steady-state	100	A	75
6b Transition	20	A	Linear Transition.
7a Steady-state	103	A	25
7b Transition	20	Linear Transition	Linear Transition.
8a Steady-state	194	B	100
8b Transition	20	B	Linear Transition.
9a Steady-state	218	B	25
9b Transition	20	Linear Transition	Linear Transition.
10a Steady-state	171	C	100
10b Transition	20	C	Linear Transition.
11a Steady-state	102	C	25
11b Transition	20	C	Linear Transition.
12a Steady-state	100	C	75
12b Transition	20	C	Linear Transition.
13a Steady-state	102	C	50
13b Transition	20	Linear Transition	Linear Transition.
14 Steady-state	168	Warm Idle	0

[1] Speed terms are defined in 40 CFR part 1065.
[2] Advance from one mode to the next within a 20-second transition phase. During the transition phase, command a linear progression from the speed or torque setting of the current mode to the speed or torque setting of the next mode.
[3] The percent torque is relative to maximum torque at the commanded engine speed.

(c) During idle mode, operate the engine at its warm idle as described in 40 CFR part 1065.

(d) See 40 CFR part 1065 for detailed specifications of tolerances and calculations.

(e) Perform the ramped-modal test with a warmed-up engine. If the ramped-modal test follows directly after testing over the Federal Test Procedure, consider the engine warm. Otherwise, operate the engine to warm it up as described in 40 CFR part 1065, subpart F.

■ 13. Section 86.1363–2007 is amended by revising paragraph (a) and the equation in paragraph (g)(1) to read as follows:

§ 86.1363–2007 Steady-state testing with a discrete-mode cycle.

* * * * *

(a) Use the following 13-mode cycle in dynamometer operation on the test engine:

Mode No.	Engine speed [1]	Percent load [2]	Weighting factors	Mode length (minutes) [3]
1	Warm Idle		0.15	4
2	A	100	0.08	2
3	B	50	0.10	2
4	B	75	0.10	2
5	A	50	0.05	2
6	A	75	0.05	2
7	A	25	0.05	2
8	B	100	0.09	2
9	B	25	0.10	2
10	C	100	0.08	2
11	C	25	0.05	2
12	C	75	0.05	2
13	C	50	0.05	2

[1] Speed terms are defined in 40 CFR part 1065.
[2] The percent torque is relative to the maximum torque at the commanded test speed.
[3] Upon Administrator approval, the manufacturer may use other mode lengths.

* * * * *

(g) * * *

(1) * * *

$$A_{WA} = \frac{\sum_{i=1}^{N}\left[A_{Mi} \cdot WF_i\right]}{\sum_{i=2}^{N}\left[A_{Pi} \cdot WF_i\right]}$$

* * * * *

Subpart P—[Amended]

■ 14. Subpart P is amended by removing § 86.1504–94.

§§ 86.1501–94 through 86.1544–84 [Redesignated]

■ 15. Redesignate §§ 86.1501–94 through 86.1544–84 as follows:

Old section	New section
86.1501–94	86.1501
86.1502–84	86.1502
86.1503–84	86.1503
86.1505–94	86.1505
86.1506–94	86.1506
86.1509–84	86.1509
86.1511–84	86.1511
86.1513–94	86.1513
86.1514–84	86.1514
86.1516–84	86.1516
86.1519–84	86.1519
86.1522–84	86.1522
86.1524–84	86.1524
86.1526–84	86.1526
86.1527–84	86.1527
86.1530–84	86.1530
86.1537–84	86.1537
86.1540–84	86.1540
86.1542–84	86.1542
86.1544–84	86.1544

■ 16. Newly desginated § 86.1506 is amended by adding paragraph (b) to read as follows:

§ 86.1506 Equipment required and specifications; overview.

* * * * *

(b) Through the 2009 model year, manufacturers may elect to use the appropriate test procedures in this part 86 instead of the procedures referenced in 40 CFR part 1065 without getting advance approval by the Administrator.

PART 89—CONTROL OF EMISSIONS FROM NEW AND IN-USE NONROAD COMPRESSION-IGNITION ENGINES

■ 17. The authority citation for part 89 continues to read as follows:

Authority: 42 U.S.C. 7401–7671q.

Subpart J—[Amended]

■ 18. A new § 89.916 is added to read as follows:

§ 89.916 Emergency-vessel exemption for marine engines below 37 kW.

The prohibitions in § 89.1003(a)(1) do not apply to new marine engines used in lifeboats and rescue boats as described in 40 CFR 94.914.

PART 92—CONTROL OF AIR POLLUTION FROM LOCOMOTIVES AND LOCOMOTIVE ENGINES

■ 19. The authority citation for part 92 continues to read as follows:

Authority: 42 U.S.C. 7401–7671q.

■ 20. Section 92.1 is amended by revising paragraph (a) introductory text and adding paragraph (e) to read as follows:

§ 92.1 Applicability.

(a) Except as noted in paragraphs (b), (d) and (e) of this section, the provisions of this part apply to manufacturers, remanufacturers, owners and operators of:

* * * * *

(e) The provisions of this part do not apply for locomotives that are subject to the emissions standards of 40 CFR part 1033.

■ 21. Section 92.2 is amended by revising the definition for ''Freshly manufactured locomotive'' to read as follows:

§ 92.2 Definitions.

* * * * *

Freshly manufactured locomotive means a locomotive which is powered by a freshly manufactured engine, and which contains fewer than 25 percent previously used parts (weighted by the dollar value of the parts). See 40 CFR 1033.640 for information about how to calculate this.

* * * * *

■ 22. Section 92.12 is amended by revising paragraph (b) and adding paragraphs (i) and (j) to read as follows:

§ 92.12 Interim provisions.

* * * * *

(b) *Production line and in-use testing.* (1) The requirements of Subpart F of this part (i.e., production line testing) do not apply prior to January 1, 2002.

(2) The testing requirements of subpart F of this part (i.e., production line testing) do not apply to small manufacturers/remanufacturers prior to January 1, 2013. Note that the production line audit requirements apply as specified.

(3) The requirements of Subpart G of this part (i.e., in-use testing) only apply for locomotives and locomotive engines that become new on or after January 1, 2002.

(4) For locomotives and locomotive engines that are covered by a small business certificate of conformity, the requirements of Subpart G of this part (i.e., in-use testing) only apply for locomotives and locomotive engines that become new on or after January 1, 2007. We will also not require small remanufacturers to perform any in-use testing prior to January 1, 2013.

* * * * *

(i) *Diesel test fuels.* Manufacturers and remanufacturers may use LSD or ULSD test fuel to certify to the standards of this part, instead of the otherwise specified test fuel, provided PM emissions are corrected as described in this paragraph (i). Measure your PM emissions and determine your cycle-weighted emission rates as specified in subpart B of this part. If you test using LSD, add 0.04 g/bhp-hr to these weighted emission rates to determine your official emission result. If you test using ULSD, add 0.05 g/bhp-hr to these weighted emission rates to determine your official emission result.

(j) *Subchapter U provisions.* For model years 2008 through 2012, certain locomotives will be subject to the requirements of this part 92 while others will be subject to the requirements of 40 CFR subchapter U. This paragraph (j) describes allowances for manufacturers or remanufacturers to ask for flexibility in transitioning to the new regulations.

(1) You may ask to use a combination of the test procedures of this part and those of 40 CFR part 1033. We will approve your request if you show us that it does not affect your ability to show compliance with the applicable emission standards. Generally this requires that the combined procedures would result in emission measurements at least as high as those that would be measured using the procedures specified in this part. Alternatively, you may demonstrate that the combined effects of the procedures is small relative to your compliance margin (the degree to which your locomotives are below the applicable standards).

(2) You may ask to comply with the administrative requirements of 40 CFR part 1033 and 1068 instead of the equivalent requirements of this part.

■ 23. Section 92.204 is amended by adding paragraph (f) to read as follows:

§ 92.204 Designation of engine families.

* * * * *

(f) Remanufactured Tier 2 locomotives may be included in the same engine family as freshly manufactured Tier 2 locomotives, provided such engines are used for locomotive models included in the engine family.