The EPA Administrator signed the following final rule on May 11, 2004. It is being submitted for publication in the *Federal Register*. While EPA has taken steps to ensure the accuracy of this Internet version, it is not the official version of the rule. Please refer to the official version in a forthcoming *Federal Register* publication and on GPO's Web Site. The rule will likely be published in the *Federal Register* around the end of May 2004. You can access the *Federal Register* at: http://www.access.gpo.gov/su_docs/aces/aces140.html. When using this site, note that "text" files may be incomplete because they don't include graphics. Instead, select "Adobe Portable Document File" (PDF) files.

ENVIRONMENTAL PROTECTION AGENCY
40 CFR Parts 9, 69, 80, 89, 94, 1039, 1048, 1051, 1065, and 1068

[OAR-2003-0012; FRL-XXXX-X]
RIN 2060-AK27

Control of Emissions of Air Pollution from Nonroad Diesel Engines and Fuel

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final Rule.

SUMMARY: Nonroad diesel engines contribute considerably to our nation's air pollution. These engines, used primarily in construction, agricultural, and industrial applications, are projected to continue to contribute large amounts of particulate matter, nitrogen oxides, and sulfur oxides, all of which contribute to serious public health problems in the United States. These problems include premature mortality, aggravation of respiratory and cardiovascular disease, aggravation of existing asthma, acute respiratory symptoms, chronic bronchitis, and decreased lung function. We believe that diesel exhaust is likely to be carcinogenic to humans by inhalation.

Today, EPA is adopting new emission standards for nonroad diesel engines and sulfur reductions in nonroad diesel fuel that will dramatically reduce harmful emissions and will directly help States and local areas recently designated as 8-hour ozone nonattainment areas to improve their air quality. This comprehensive national program regulates nonroad diesel engines and diesel fuel as a system. New engine standards will begin to take effect in the 2008 model year, phasing in over a number of years. These standards are based on the use of advanced exhaust emission control devices. We estimate particulate matter reductions of 95 percent, nitrogen oxides reductions of 90 percent, and the virtual elimination of sulfur oxides from nonroad engines meeting the new standards. Nonroad diesel fuel sulfur reductions of more than 99 percent from existing levels will provide significant health benefits as well as facilitate the introduction of high-efficiency catalytic exhaust emission control devices as these devices are damaged by sulfur. These fuel controls will be phased-in starting in mid-2007. Today's nonroad final rule is largely based on the Environmental Protection Agency's 2007 highway diesel program.

To better ensure the benefits of the standards are realized in-use and throughout the useful life of these engines, we are also adopting new test procedures, including not-to-exceed requirements, and related certification requirements. The rule also includes provisions to facilitate the transition to the new engine and fuel standards and to encourage the early

introduction of clean technologies and clean nonroad diesel fuel. We have also developed provisions for both the engine and fuel programs designed to address small business considerations.

The requirements in this rule will result in substantial benefits to public health and welfare through significant reductions in emissions of nitrogen oxides and particulate matter, as well as nonmethane hydrocarbons, carbon monoxide, sulfur oxides, and air toxics. We are now projecting that by 2030, this program will reduce annual emissions of nitrogen oxides and particulate matter by 738,000 and 129,000 tons, respectively. These emission reductions will prevent 12,000 premature deaths, over 8,900 hospitalizations, and almost a million work days lost, and will achieve other quantifiable benefits every year. The total benefits of this rule will be approximately $80 billion annually by 2030. The substantial health and welfare benefits we are projecting for this final action exceed those we anticipated at the time of this proposal. Costs for both the engine and fuel requirements will be many times less, at approximately $2 billion annually.

DATES: This final rule is effective on **[insert date 60 days after publication in the Federal Register]**.

The incorporation by reference of certain publications listed in this regulation is approved by the Director of the *Federal Register* as of **[insert date 60 days after publication in the Federal Register]**.

ADDRESSES: EPA has established a docket for this action under Docket ID Nos. OAR-2003-0012 and A-2001-28. All documents in the docket are listed in the EDOCKET index at http://www.epa.gov/edocket. Although listed in the index, some information is not publicly available, i.e., CBI or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, is not placed on the Internet and will be publicly available only in hard copy form. Publicly available docket materials are available either electronically in EDOCKET or in hard copy at the Air Docket in the EPA Docket Center, EPA/DC, EPA West, Room B102, 1301 Constitution Ave., NW, Washington, DC. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566-1744, and the telephone number for the Air Docket is (202) 566-1742.

FOR FURTHER INFORMATION CONTACT: Carol Connell, Assessment and Standards Division, Office of Transportation and Air Quality, Environmental Protection Agency, 2000 Traverwood Drive, Ann Arbor, MI 48105; telephone number: (734) 214-4349; fax number: (734) 214-4050; e-mail address: connell.carol@epa.gov, or Assessment and Standards Division Hotline; telephone number: (734) 214-4636; e-mail address: asdinfo@epa.gov.

SUPPLEMENTARY INFORMATION:
Does this action apply to me?

This action may affect you if you produce or import new diesel engines which are intended for use in nonroad vehicles or equipment, such as agricultural and construction equipment, or if you produce or import such nonroad vehicles or equipment. It may also affect you if you convert nonroad vehicles or equipment, or the engines used in them, to use alternative fuels. It may also affect you if you produce, import, distribute, or sell nonroad diesel fuel.

The following table gives some examples of entities that may have to follow the regulations. But because these are only examples, you should carefully examine the regulations in 40 CFR parts 80, 89, 1039, 1065, and 1068. If you have questions, call the person listed in the FOR FURTHER INFORMATION CONTACT section of this preamble:

Category	**NAICS codes[a]**	**SIC codes[b]**	**Examples of potentially regulated entities**
Industry.....	333618	3519	Manufacturers of new nonroad diesel engines
Industry.....	333111	3523	Manufacturers of farm machinery and equipment
Industry.....	333112	3524	Manufacturers of lawn and garden tractors (home)
Industry.....	333924	3537	Manufacturers of industrial trucks
Industry.....	333120	3531	Manufacturers of construction machinery
Industry.....	333131	3532	Manufacturers of mining machinery and equipment
Industry.....	333132	3533	Manufacturers of oil and gas field machinery and equipment
Industry.....	811112 811198	7533 7549	Commercial importers of vehicles and vehicle components
Industry.....	324110	2911	Petroleum refiners
Industry.....	422710 422720	5171 5172	Diesel fuel marketers and distributors
Industry.....	484220 484230	4212 4213	Diesel fuel carriers

Notes: [a] North American Industry Classification System (NAICS). [b] Standard Industrial Classification (SIC) system code.

How Can I Get Copies of This Document and Other Related Information?

Docket. EPA has established an official public docket for this action under Docket ID No. OAR-2003-0012 at http://www.epa.gov/edocket. The official public docket consists of the documents specifically referenced in this action, any public comments received, and other information related to this action. Although a part of the official docket, the public docket does

not include Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. The official public docket is the collection of materials that is available for public viewing at the Air Docket in the EPA Docket Center, (EPA/DC) EPA West, Room B102, 1301 Constitution Ave., NW, Washington, DC. The EPA Docket Center Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Reading Room is (202) 566-1742, and the telephone number for the Air Docket is (202) 566-1742.

Electronic Access. You may access this Federal Register document electronically through the EPA Internet under the "Federal Register" listings at *http://www.epa.gov/fedrgstr*/.

An electronic version of the public docket is available through EPA's electronic public docket and comment system, EPA Dockets. You may use EPA Dockets at http://www.epa.gov/edocket/ to view public comments, access the index listing of the contents of the official public docket, and to access those documents in the public docket that are available electronically. Although not all docket materials may be available electronically, you may still access any of the publicly available docket materials through the docket facility identified above. Once in the system, select "search," then key in the appropriate docket identification number.

Outline of This Preamble

I. Overview
- A. What is EPA Finalizing?
- B. Why Is EPA Taking this Action?

II. Nonroad Engine Standards
- A. What Are the New Engine Standards?
- B. Are the New Standards Feasible?
- C. Why Do We Need 15ppm Sulfur Diesel Fuel?

III. Requirements for Engine and Equipment Manufacturers
- A. Averaging, Banking, and Trading
- B. Transition Provisions for Equipment Manufacturers
- C. Engine and Equipment Small Business Provisions (SBREFA)
- D. Certification Fuel
- E. Temporary In-Use Compliance Margins
- F. Test Cycles
- G. Other Test Procedure Issues
- H. Engine Power
- I. Auxiliary Emission Control Devices and Defeat Devices
- J. Not-To-Exceed Requirements
- K. Investigating and Reporting Emission-Related Defects
- L. Compliance with the Phase-In Provisions

M. Incentive Program for Early or Very Low Emission Engines
N. Labeling and Notification Requirements
O. General Compliance
P. Other Issues
Q. Highway Engines
R. Changes That Affect Other Engine Categories

IV. Our Program for Controlling Nonroad, Locomotive and Marine Diesel Fuel Sulfur
A. Nonroad, Locomotive and Marine Diesel Fuel Quality Standards
B. Hardship Relief Provisions for Qualifying Refiners
C. Special Provisions for Alaska and the Territories
D. NRLM Diesel Fuel Program Design
E. How Are State Diesel Fuel Programs Affected by the Sulfur Diesel Program?
F. Technological Feasibility of the 500 and 15 ppm Sulfur Diesel Fuel Program
G. What Are the Potential Impacts of the 15 ppm Sulfur Diesel Program on Lubricity and Other Fuel Properties?
H. Refinery Air Permitting

V. Nonroad, Locomotive and Marine Diesel Fuel Program: Details of the Compliance and Enforcement Provisions
A. Special Fuel Provisions and Exemptions
B. Additional Requirements for Refiners and Importers
C. Requirements for Parties Downstream of the Refinery or Import Facility
D. Diesel Fuel Sulfur Sampling and Testing Requirements
E. Selection of the Marker for Heating Oil
F. Fuel Marker Test Method
G. Requirements for Record-keeping, Reporting, and PTDs
H. Liability and Penalty Provisions for Noncompliance
I. How Will Compliance with the Sulfur Standards Be Determined?

VI. Program Costs and Benefits
A. Refining and Distribution Costs
B. Cost Savings to the Existing Fleet from the Use of Low Sulfur Fuel
C. Engine and Equipment Cost Impacts
D. Annual Costs and Cost Per Ton
E. Do the Benefits Outweigh the Costs of the Standards?
F. Economic Impact Analysis

VII. Alternative Program Options Considered
A. Summary of Alternatives
B. Introduction of 15 ppm Nonroad Diesel Sulfur Fuel in One Step
C. Applying the 15 ppm Sulfur Cap to Locomotive and Marine Diesel Fuel
D. Other Alternatives

VIII. Future Plans
- A. Technology Review
- B. Test Procedure Issues
- C. In-use Testing
- D. Engine Diagnostics
- E. Future NO_X Standards for Engines in Mobile Machinery Over 750 hp
- F. Emission Standards for Locomotive and Marine Diesel Engines
- G. Retrofit Programs
- H. Reassess the Marker Specified for Heating Oil

IX. Public Participation

X. Statutory and Executive Order Reviews
- A. Executive Order 12866: Regulatory Planning and Review
- B. Paperwork Reduction Act
- C. Regulatory Flexibility Act (RFA), as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), 5 USC 601 et. seq
- D. Unfunded Mandates Reform Act
- E. Executive Order 13132: Federalism
- F. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments
- G. Executive Order 13045: Protection of Children from Environmental Health and Safety Risks
- H. Executive Order 13211: Actions that Significantly Affect Energy Supply, Distribution, or Use
- I. National Technology Transfer Advancement Act
- J. Congressional Review Act

XI. Statutory Provisions and Legal Authority

I. Overview

EPA today is completing the third recent major program to reduce emissions from the nation's mobile sources. Today's final rule establishes standards for nonroad diesel engines and fuel and builds on the recently adopted Tier 2 program for cars and light trucks and the 2007 highway diesel program for on-highway diesel engines. These three programs have in common large reductions in sulfur levels in fuel that will not only achieve public health benefits but also facilitate the introduction of advanced emissions control technologies. In 1996, emissions from land-based nonroad, marine, and locomotive diesel engines were estimated to be about 40 percent of the total mobile source inventory of $PM_{2.5}$ (particulate matter less than 2.5 microns in diameter) and 25 percent of the NO_X (nitrogen oxides) inventory. Without today's final rule, these contributions would be expected to grow to 44 percent and 47 percent by 2030 for $PM_{2.5}$ and $NO_{X,}$ respectively. By themselves, land-based nonroad diesel engines are a very large part of the diesel mobile source $PM_{2.5}$ inventory, contributing about 47 percent in 1996, and growing to 70 percent of this inventory by 2020 without today's final rule. In order to meet the Clean Air Act's goal of cleaning up the nation's air, emissions reductions from the nonroad sector are necessary.

This program begins to get important emission reductions in 2008, and by 2030 we estimate that this program will reduce over 129,000 tons $PM_{2.5}$ and 738,000 tons of NO_X annually. These emission reductions will be directly helpful to the 474 counties nationwide that have been recently designated as nonattainment areas for the 8-hour ozone standard and for counties that will be designated as nonattainment for $PM_{2.5}$ later this year. The resulting ambient $PM_{2.5}$ and NO_X reductions correspond to public health improvements in 2030 including approximately 12,000 fewer premature mortalities, 15,000 fewer heart attacks, 1 million fewer lost days of work due to adults with respiratory symptoms, 5.9 million fewer days when adults have to restrict their activities due to respiratory symptoms, and almost 6,000 emergency room visits for asthma attacks in children. Our projections in this final rule for public health and welfare improvements are greater than estimated at proposal.

This final rule sets out emission standards for nonroad diesel engines - engines used mainly in construction, agricultural, industrial and mining operations - that will achieve reductions in PM and NO_X emissions levels in excess of 95 percent and 90 percent respectively. This action also regulates nonroad diesel fuel for the first time by reducing sulfur levels in this fuel more than 99 percent to 15 parts per million (ppm). These provisions mirror those already in place for highway diesel engines, which will lead to the introduction of 15 ppm sulfur diesel fuel, followed by stringent engine standards in that sector beginning in 2007 based on advanced aftertreatment technologies. We believe it is highly appropriate to bring the same types of expected advanced aftertreatment technologies to the nonroad market as soon as possible and we believe today's nonroad fuel and engine program represents the next step in a feasible progression in the application of clean technologies to nonroad diesel engines and the associated diesel fuel.

As we did with the proposed nonroad rulemaking, we followed specific principles when developing this final rule. First, the program achieves reductions in NO_X, sulfur oxides (SO_X), and PM emissions as early as possible. Second, it does so by implementing the fuel program as soon as possible while at the same time not interfering with the implementation and expected benefits of introducing ultra low sulfur fuel (diesel fuel containing no greater than 15 ppm sulfur) in the highway market as required by the 2007 highway diesel rule. Next, we are generally treating vehicles and fuels as a system, that is promulgating engine and fuel standards in tandem in order to cost-effectively achieve the greatest emission reductions. Lastly, the program provides sufficient lead time to allow the migration of advanced emissions control technologies from the highway sector to nonroad diesel engines as well as the expansion of ultra low sulfur diesel fuel production to the nonroad market.

The May 2003 proposed rulemaking culminated a multi-year effort to develop control strategies for nonroad engines. EPA worked collaboratively with stakeholders from industry, state and local government, and public health organizations in putting together its comprehensive (and widely praised) new engine standards and sulfur fuel controls. We received about 150,000 comments on the proposal, almost all of them in support. We held three public hearings on the proposal and have participated in scores of meetings with commenters in developing the provisions of today's final rule. An important aspect of this collaborative development effort has been EPA's coordination with other governments in helping to further world harmonization of nonroad engine controls and fuel sulfur levels. Information gathered in these comments and discussions, taken in context with the principles described above, has been the basis for our action today.

In summary, this rule sets out engine standards and emission test procedures (including not-to-exceed requirements) for new nonroad diesel engines, and sulfur control requirements for diesel fuel used in land-based nonroad, locomotive, and marine engines (NRLM fuel). Beginning in 2008, the new Tier 4 engine standards for five power categories for engines from under 25 horsepower (hp) to above 750 horsepower will be phased in. New engine emissions test procedures will be phased in along with these new standards to better ensure emissions control over real-world engine operation and to help provide for effective compliance determination. The sulfur reductions to land-based nonroad diesel fuel will be accomplished in two steps, with an interim step from currently uncontrolled levels to a 500 ppm cap starting in June, 2007 and the final step to 15 ppm in June, 2010. This change in fuel quality will directly lead to important health and welfare benefits associated with the reduced generation of sulfate PM and SO_X. Even more important, introduction of 15 ppm sulfur nonroad diesel fuel facilitates the introduction of advanced aftertreatment devices for nonroad engines.

Although we did not propose to control locomotive and marine diesel fuel sulfur levels to 15 ppm in the NPRM, recognizing the important environmental and public welfare benefits that such a program could enable, we have decided to finalize this second step to 15 ppm sulfur fuel control program for locomotive and marine diesel fuel beginning in 2012. Locomotive and marine diesel fuel will first be reduced from current uncontrolled levels to a 500 ppm cap starting

in June 2007 and the second step down to a 15 ppm cap will take place in June, 2012. While we have chosen to reduce sulfur levels in locomotive and marine diesel fuel to 15 ppm in this rulemaking without adopting corresponding engine controls, we note that the Agency has already begun work to promulgate appropriate new standards for these engines.[1] The monetized health and welfare benefits associated with further sulfur reduction to 15 ppm outweigh the costs of the sulfur reductions. Also, doing so now allows for the promulgation of a single integrated fuel program and provides the refining industry with long term predictability for sulfur control.

The requirements in this rule will result in substantial benefits to public health and welfare and the environment through significant reductions in NO_X and PM as well as nonmethane hydrocarbons (NMHC), carbon monoxide (CO), SO_X, and air toxics. As noted, by 2030 this program will reduce annual emissions of NO_X and PM by 738,000 and 129,000 tons, respectively. We estimate these annual emission reductions will prevent 12,000 premature deaths, over 8,900 hospitalizations, 15,000 nonfatal heart attacks, and approximately 1 million days that people miss work because of respiratory symptoms, among quantifiable benefits. The overall quantifiable benefits will total $83 billion annually by 2030 using a 3 percent discount rate and $78 billion using a 7 percent discount rate at a cost of approximately $2 billion, with a 30-year net present value for the benefits of $805 billion at 3 percent discounting and $352 billion at 7 percent discounting at a net present value cost of $27 billion at 3 percent discounting and $14 billion at 7 percent discounting. Clearly the benefits of this program dramatically outweigh its cost at a ratio of approximately 40:1 in 2030.

A. What is EPA Finalizing?

As part of the proposed rulemaking, we set out very detailed provisions for new engine exhaust emission controls, sulfur limitations in nonroad and locomotive/marine diesel fuels, test procedures, compliance requirements, and other information. We also looked at a number of alternative program options, such as requiring refiners to reduce sulfur from uncontrolled levels to 15 ppm in one step in 2008. We continue to believe that the main program options set out in the proposal are feasible and the most cost-effective requirements, taking into account other factors such as lead time and interaction with the highway diesel program, so we are generally adopting the engine and fuel provisions which we proposed.

1. Nonroad Diesel Engine Emission Standards

Today's action adopts Tier 4 standards for nonroad diesel engines of all horsepower ratings. These standards are technology-neutral in the sense that manufacturers are the responsible party in determining which emission control technologies will be needed to meet the requirements. Applicable emissions standards are determined by model year for each of five engine power band categories. For engines less than 25 hp, we are adopting a new engine

[1] EPA is issuing an Advanced Notice of Proposed Rulemaking for locomotive and marine engine standards as part of this effort.

standard for PM of 0.30 g/bhp-hr (grams per brake-horsepower-hour) beginning in 2008, and leaving the previously-set 5.6 g/bhp-hr combined standard for NMHC+NO_X in place. For engines of 25 to 75 hp, we are adopting standards reflecting approximately 50 percent reductions in PM control from today's engines, again applicable beginning in 2008. Then, starting in 2013, standards of 0.02 g/bhp-hr for PM and 3.5 g/bhp-hr for NMHC+NO_X will apply for this power category. For engines of 75 to 175 hp, the standards will be 0.01 g/bhp-hr for PM, 0.30 g/bhp-hr for NO_X and 0.14 g/bhp-hr for NMHC starting in 2012, with the NO_X and NMHC standards phased in over a period of three to four years in order to address lead time, workload, and feasibility considerations. These same standards will apply to engines of 175 to 750 hp as well starting in 2011, with a similar phase-in. These PM, NO_X, and NMHC standards and phase-in schedules are similar in stringency to the 2007 highway diesel standards and are expected to require the use of high-efficiency aftertreatment systems to ensure compliance.

For engines above 750 hp, we are requiring PM and NMHC control to 0.075 g/bhp-hr and 0.30 g/bhp-hr, respectively, starting in 2011. More stringent standards take effect in 2015 with PM standards of 0.02 g/bhp-hr (for engines used in generator sets) and 0.03 g/bhp-hr (for non-generator set engines), and an NMHC standard of 0.14 g/bhp-hr. The NO_X standard in 2011 will be 0.50 g/bhp-hr for generator set engines above 1200 hp, and 2.6 g/bhp-hr for all other engines in the above 750 hp category. This application of advanced NO_X emission control technologies to generator set engines above 1200 hp will provide substantial NO_X reductions and will occur earlier than we had proposed in the NPRM. In 2015, the 750-1200 hp generator set engines will be added to the stringent 0.50 g/bhp-hr NO_X requirement as well. The long-term NO_X standard for engines not used in generator sets (mobile machinery) will be addressed in a future action (we are currently considering such an action in the 2007 time frame).

We are also continuing the averaging, banking, and trading provisions engine manufacturers can use to demonstrate compliance with the standards. We also are continuing provisions providing flexibilities which equipment manufacturers may use to facilitate transition to compliance with the new standards. In addition, we are including turbocharged diesels in the existing regulation of crankcase emissions, effective in the same year that the new standards first apply in each power category.

As discussed at length in the proposal, new test procedures and compliance provisions, especially the not-to-exceed and transient tests, are necessary to ensure the benefits of the standards being adopted today are achieved when the aftertreatment-based standards go into place. We are therefore adopting the proposed test procedures and compliance provisions, with slight modifications designed to better implement the provisions, in today's rule. We continue to believe the new transient test, cold start transient test, and not-to-exceed test procedures and standards will all help achieve our goal of emissions reductions being achieved in actual engine operation.

As noted, the final rule also continues, and in some cases modifies, existing provisions that will facilitate the transition to the new engine and fuel standards. Many of these provisions

will help small business engine and equipment manufacturers meet the requirements. They will also aid manufacturers in managing their development of engines and equipment that will meet our new standards.

2. Nonroad, Locomotive, and Marine Diesel Fuel Quality Standards

The fuel program requirements are very similar to those included in the proposal, with two notable exceptions. The first involves the standards themselves with the inclusion of locomotive and marine diesel fuel in the 15 ppm standard. The second addresses the compliance provisions designed to ensure the effectiveness of the program.

We are adopting the two-step approach to sulfur control, with all land-based nonroad, locomotive, and marine diesel fuel going from uncontrolled sulfur levels of approximately 3,000 ppm sulfur to 500 ppm in June, 2007. The interim step will by itself achieve significant PM and SO_X emission reductions with associated important health benefits as early as is practicable. Then, in June 2010, the sulfur cap for land-based nonroad engine diesel fuel will be reduced to the final standard of 15 ppm. Two years later, in 2012, the 15 ppm cap for locomotive and marine engine diesel fuel will go into effect. The reduction to 15 ppm sulfur provides additional direct control of PM and SO_X emissions and is an enabling technology for the application of advanced catalyst-based emission control technologies.

Although we did not propose to control locomotive and marine diesel fuel to 15 ppm in the NPRM, after careful consideration and reviewing substantial comments from stakeholders, we have decided to include fuel used in locomotive and marine applications in the final step to 15 ppm beginning in 2012. The incremental PM health and welfare benefits associated with this standard outweigh the costs. The locomotive and marine diesel fuel program provides a near-term positive impact on public health and welfare. Also, the 15 ppm sulfur diesel fuel provides an opportunity that may enable the application of advanced catalyst-based emission control technologies to locomotive and marine diesel engines. We are issuing an Advance Notice of Proposed Rulemaking for locomotive and marine diesel engines that investigates this potential. Recognizing the value that a locomotive and marine fuel program could have for public health and welfare, State and local authorities and public health advocacy organizations provided a large number of comments encouraging us to take action in this rulemaking to address emissions from this category.

Including locomotive and marine fuel in the 15 ppm sulfur diesel fuel pool also simplifies the overall design of the fuel program and will simplify the distribution of diesel fuel. At the same time, we have finalized this standard with flexibilities designed specifically to address fuel program implementation issues raised in the comments.

Noting that sulfur levels in highway diesel fuel will generally be at or below 15 ppm starting in 2006 and not wanting to reduce the benefits of introducing this clean fuel, we spent considerable time developing a compliance assurance scheme for introducing our nonroad diesel

sulfur program to mesh with the highway program requirements. We initially thought that a "baseline" approach essentially requiring refiners to maintain a constraint on sulfur levels of various distillate fuels, based on historical production volumes, was the most appropriate mechanism. Subsequently we learned that the other mechanism we discussed in the proposal, a "designate and track" type approach, is better suited to address our priorities and commitments for the nonroad diesel sulfur control program. This approach allows refiners to designate volumes of nonroad fuel into various categories and these designations would follow the fuel throughout the distribution system. We have successfully worked through our enforceability and other concerns with this approach and are now including it as our compliance mechanism for the fuel standards of today's program.

B. Why Is EPA Taking this Action?

As we have discussed extensively in both the proposal and today's action, EPA strongly believes it is appropriate to take steps now to reduce future emissions from nonroad, locomotive, and marine diesel engines. Emissions from these engines contribute greatly to a number of serious air pollution problems and would continue to do so in the future absent further reduction measures. Such emissions lead to adverse health and welfare effects associated with ozone, PM, NO_X, SO_X, and volatile organic compounds, including toxic compounds. In addition, diesel exhaust is of specific concern because it is likely to be carcinogenic to humans by inhalation as well as posing a hazard from noncancer respiratory effects. Ozone, NO_X, and PM also cause significant public welfare harm such as damage to crops, eutrophication, regional haze, and soiling of building materials.

Millions of Americans continue to live in areas with unhealthy air quality that may endanger public health and welfare. As discussed in more detail below, there are approximately 159 million people living in areas that either do not meet the 8-hour ozone National Ambient Air Quality Standards (NAAQS) or contribute to violations in other counties as noted in EPA's recent nonattainment designations for part or all of 474 counties. In addition, approximately 65 million people live in counties where air quality measurements violate the $PM_{2.5}$ NAAQS. These numbers do not include the tens of millions of people living in areas where there is a significant future risk of failing to maintain or achieve the ozone or $PM_{2.5}$ NAAQS. Federal, state, and local governments are working to bring ozone and PM levels into compliance with the NAAQS attainment and maintenance plans and the reductions included in today's rule will play a critical part in these actions. Reducing regional emissions of SO_X is critical to this strategy for attaining the PM NAAQS and meeting regional haze goals in our treasured national parks. SO_X levels can themselves pose a respiratory hazard.

Although controlling air pollution from nonroad diesel exhaust is challenging, we strongly believe it can be accomplished through the application of high-efficiency emissions control technologies. As discussed in much greater detail in section II, very large emission reductions (in excess of 90 percent) are possible, especially through the use of catalytic emission control devices installed in the nonroad equipment's exhaust system and integrated with the

engine controls. To meet the standards being adopted today, application of such technologies for both PM and NO_X control will be needed for most engines. High-efficiency PM exhaust emission control technology has been available for several years, and it is the same technology we expect to be applied to meet the PM standards for highway diesel engines in 2007. For NO_X, we expect the same high-efficiency technologies being developed for the 2007 highway diesel engine program will be used to meet our new nonroad requirements. All of these technologies are dependent on the 15 ppm maximum sulfur levels for nonroad diesel fuel being adopted today. The fuel control program being adopted today also yields significant and important reductions in SO_X from these sources.

1. Basis For Action Under the Clean Air Act

Section 213 of the Clean Air Act ("the Act" or CAA) gives us the authority to establish emissions standards for nonroad engines and vehicles. Section 213(a)(3) authorizes the Administrator to set standards for NO_X, volatile organic compounds (VOCs), and CO which "standards shall achieve the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the engines or vehicles." As part of this determination, the Administrator must give appropriate consideration to cost, lead time, noise, energy, and safety factors associated with the application of such technology. The standards adopted today for NO_X implement this provision. Section 213(a)(4) authorizes the Administrator to establish standards to control emissions of pollutants (other than those covered by section 213(a)(3)) which "may reasonably be anticipated to endanger public health and welfare." Here, the Administrator may promulgate regulations that are deemed appropriate for new nonroad vehicles and engines which cause or contribute to such air pollution, taking into account costs, noise, safety, and energy factors. EPA believes the new controls for PM in today's rule are an appropriate exercise of EPA's discretion under the authority of section 213(a)(4).

We believe the evidence provided in section II of this preamble and in the Regulatory Impact Analysis (RIA) indicates that the stringent emission standards adopted today are feasible and reflect the greatest degree of emission reduction achievable in the model years to which they apply. We have given appropriate consideration to costs in promulgating these standards. Our review of the costs and cost-effectiveness of these standards indicate that they will be reasonable and comparable to the cost-effectiveness of other emission reduction strategies for the same pollutants that have been required or could be required in the future. We have also reviewed and given appropriate consideration to the energy factors of this rule in terms of fuel efficiency and effects on diesel fuel supply, production, and distribution, as discussed below, as well as any safety factors associated with these new standards.

The information in this section and chapters 2 and 3 of the RIA regarding air quality and the contribution of nonroad, locomotive, and marine diesel engines to air pollution provides strong evidence that emissions from such engines significantly and adversely impact public health or welfare. First, as noted earlier, there is a significant risk that several areas will fail to

attain or maintain compliance with the NAAQS for 8-hour ozone concentrations or the NAAQS for $PM_{2.5}$ during the period that these new vehicle and engine standards will be phased into the vehicle population, and that nonroad, locomotive, and marine diesel engines contribute to such concentrations, as well as to concentrations of other criteria pollutants. This risk will be significantly reduced by the standards adopted today, as also noted above. However, the evidence indicates that some risk remains even after the reductions achieved by these new controls on nonroad diesel engines and nonroad, locomotive, and marine diesel fuel. Second, EPA believes that diesel exhaust is likely to be carcinogenic to humans. The risk associated with exposure to diesel exhaust includes the particulate and gaseous components among which are benzene, formaldehyde, acetaldehyde, acrolein, and 1,3-butadiene, all of which are known or suspected human or animal carcinogens, or have noncancer health effects. Moreover, these compounds have the potential to cause health effects at environmental levels of exposure. Third, emissions from nonroad diesel engines (including locomotive and marine diesel engines) contribute to regional haze and impaired visibility across the nation, as well as to odor, acid deposition, polycyclic organic matter (POM) deposition, eutrophication and nitrification, all of which are serious environmental welfare problems.

EPA has already found in previous rules that emissions from new nonroad diesel engines contribute to ozone and CO concentrations in more than one area which has failed to attain the ozone and CO NAAQS (59 FR 31306, June 17, 1994). EPA has also previously determined that it is appropriate to establish standards for PM from new nonroad diesel engines under section 213(a)(4), and the additional information on diesel exhaust carcinogenicity noted above reinforces this finding. In addition, we have already found that emissions from nonroad engines significantly contribute to air pollution that may reasonably be anticipated to endanger public welfare due to regional haze and visibility impairment (67 FR 68242 -68243, Nov. 8, 2002). We find here, based on the information in this section of the preamble and chapters 2 and 3 of the RIA, that emissions from the new nonroad diesel engines covered by this final action likewise contribute to regional haze and to visibility impairment that may reasonably be anticipated to endanger public welfare. Taken together, these findings indicate the appropriateness of the nonroad diesel engine standards adopted today for purposes of section 213(a)(3) and (4) of the Act. These findings were unchallenged by commenters.

These standards must take effect at the "the earliest possible date considering the lead time necessary to permit development and application of the requisite technology," giving "appropriate consideration" to cost, energy, and safety.[2] The compliance dates we are adopting reflect careful consideration of these factors. The averaging, banking, and trading (ABT), equipment manufacturer flexibilities, and phase-in provisions for NO_X are elements in our determination that we have selected appropriate lead times for the standards.

Section 211(c) of the CAA allows us to regulate fuels where emission products of the fuel either: 1) cause or contribute to air pollution that reasonably may be anticipated to endanger

[2] See Clean Air Act section 213(b).

public health or welfare, or 2) will impair to a significant degree the performance of any emission control device or system which is in general use, or which the Administrator finds has been developed to a point where in a reasonable time it will be in general use were such a regulation to be promulgated. This rule meets both of these criteria. Sulfur dioxide (SO_2)and sulfate PM emissions from nonroad, locomotive, marine and diesel vehicles are due to sulfur in diesel fuel. As discussed above, emissions of these pollutants cause or contribute to ambient levels of air pollution that endanger public health and welfare. Control of sulfur to 15 ppm for this fuel through a two-step program would lead to significant, cost-effective reductions in emissions of these pollutants. Control of sulfur to 15 ppm in nonroad diesel fuel will also enable emissions control technology that will achieve significant, cost-effective reduction in emissions of these pollutants, as discussed in section I.B.2 below. The substantial adverse effect of high sulfur levels on the performance of diesel emission control devices or systems that would be expected to be used to meet the nonroad standards is discussed in detail in section II. Control of sulfur to 15 ppm for locomotive and marine diesel fuel, as with nonroad diesel fuel, will provide meaningful additional benefits that outweigh the costs. In addition, our authority under section 211(c) is discussed in more detail in Appendix A to chapter 5 of the RIA.

2. What Is the Air Quality Impact of this Final Rule?

a. Public Health and Environmental Impacts

With this rulemaking, we are acting to extend advanced emission controls to another major source of diesel engine emissions: nonroad land-based diesel engines. This final rule sets out emission standards for nonroad land-based diesel engines - engines used mainly in construction, agricultural, industrial and mining operations - that will achieve reductions in PM and NO_X standards in excess of 95 percent and 90 percent, respectively for this class of vehicles. This action also regulates nonroad diesel fuel for the first time by reducing sulfur levels in this fuel more than 99 percent to 15 ppm. The diesel fuel sulfur requirements will decrease PM and SO_2 emissions for land-based diesel engines, as well as for three other nonroad source categories: commercial marine diesel vessels, locomotives, and recreational marine diesel engines.

These sources are significant contributors to atmospheric pollution of (among other pollutants) PM, ozone and a variety of toxic air pollutants. In 1996, emissions from these four source categories were estimated to be 40 percent of the mobile source inventory for $PM_{2.5}$ and 25 percent for NO_X, and 10 percent and 13 percent of overall emissions for these potential health hazards, respectively. Without further controls beyond those we have already adopted, these sources will emit 44 percent of $PM_{2.5}$ from mobile sources and 47 percent of NO_X emissions from mobile sources by the year 2030.

Nonroad engines, and most importantly nonroad diesel engines, contribute significantly to ambient $PM_{2.5}$ levels, largely through direct emissions of carbonaceous and sulfate particles in the fine (and even ultrafine) size range. Nonroad diesels also currently emit high levels of NO_X which react in the atmosphere to form secondary $PM_{2.5}$ (namely ammonium nitrate) as well as

ozone. Nonroad diesels also emit SO_2 and hydrocarbons which react in the atmosphere to form secondary $PM_{2.5}$ (namely sulfates and organic carbonaceous $PM_{2.5}$). This section summarizes key points regarding the nonroad diesel engine contribution to these pollutants and their impacts on human health and the environment. EPA notes that we are relying not only on the information presented in this preamble, but also on the more detailed information in chapters 2 and 3 of the RIA and technical support documents, as well as information in the preamble, RIA, and support documents for the proposed rule.

When fully implemented, this final rule will reduce nonroad (equipment such as construction, agricultural, and industrial), diesel $PM_{2.5}$ and NO_X emissions by 95 percent and 90 percent, respectively. It will also virtually eliminate nonroad diesel SO_2 emissions, which amounted to approximately 234,000 tons in 1996, and would otherwise grow to approximately 326,000 tons by 2020. These dramatic reductions in nonroad emissions are a critical part of the effort by federal, state and local governments to reduce the health related impacts of air pollution and to reach attainment of the NAAQS for PM and ozone, as well as to improve other environmental effects such as atmospheric visibility. Based on the most recent data available for this rule, such problems are widespread in the United States. There are almost 65 million people living in 120 counties with monitored $PM_{2.5}$ levels (2000-2002) exceeding the $PM_{2.5}$ NAAQS, and 159 million people living in areas recently designated as exceeding 8-hour ozone NAAQS. Figure I-1 illustrates the widespread nature of these problems. Shown in this figure are counties exceeding the $PM_{2.5}$ NAAQS or designated for nonattainment with the 8-hour ozone NAAQS plus mandatory Federal Class I areas, which have particular needs for reductions in atmospheric haze.

Our air quality modeling also indicates that similar conditions are likely to continue to persist in the future in the absence of additional controls and that the emission reductions would assist areas with attainment and future maintenance of the PM and ozone NAAQS.[3] For example, in 2020, based on emission controls currently adopted, we project that 66 million people will live in 79 counties with average $PM_{2.5}$ levels above 15 micrograms per cubic meter (ug/m^3). In 2030, the number of people projected to live in areas exceeding the $PM_{2.5}$ standard is expected to increase to 85 million in 107 counties. An additional 24 million people are projected to live in counties within 10 percent of the standard in 2020, which will increase to 64 million people in 2030. Furthermore, for ozone, in 2020, based on emission controls currently adopted, the number of counties violating the 8-hour ozone standard is expected to decrease to 30 counties where 43 million people are projected to live. Thereafter, exposure to unhealthy levels of ozone is expected to begin to increase again. In 2030 the number of counties violating the 8-hour ozone NAAQS is projected to increase to 32 counties where 47 million people are projected to live. In

[3] Note this analysis does not include the effects of the proposed Rule to Reduce Interstate Transport of Fine Particulate Matter and Ozone (Interstate Air Quality Rule). 69 FR 4566 (January 30, 2004). See http://www.epa.gov/interstateairquality/rule.html

addition, in 2030, 82 counties where 44 million people are projected to live will be within 10 percent of violating the ozone 8-hour NAAQS.

Figure I-1. Air Quality Problems are Widespread

EPA is still developing the implementation process for bringing the nation's air into attainment with the $PM_{2.5}$ and 8-hour ozone NAAQS. Based on section 172(a) provisions in the Act, designated areas will need to attain the $PM_{2.5}$ NAAQS in the 2010 (based on 2007 - 2009 air quality data) to 2015 (based on 2012 to 2014 air quality data) time frame, and then be required to maintain the NAAQS thereafter. Similarly, we expect that most areas covered under subpart 1 and 2 will attain the ozone standard in the 2007 to 2014 time frame, depending on an area's classification and other factors, and then be required to maintain the NAAQS thereafter.

Since the emission reductions expected from this final rule would begin in this same time frame, the projected reductions in nonroad emissions would be used by states in meeting the $PM_{2.5}$ and ozone NAAQS. In their comments on the proposal, states told EPA that they need nonroad diesel engine reductions in order to be able to meet and maintain the $PM_{2.5}$ and ozone NAAQS as well as to make progress toward visibility requirements.[4] Furthermore, this action would ensure that nonroad diesel emissions will continue to decrease as the fleet turns over in the years beyond 2014; these reductions will be important for maintenance of the NAAQS following attainment.

Scientific studies show ambient PM is associated with a series of adverse health effects. These health effects are discussed in detail in the EPA Criteria Document for PM as well as the

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[4] The following are sample comments from states and state associations on the proposed rule, which corroborate that this rule is a critical element in States' NAAQS attainment efforts. Fuller information can be found in the Summary and Analysis of Comments.

- "Unless emissions from nonroad diesels are sharply reduced, it is very likely that many areas of the country will be unable to attain and maintain health-based NAAQS for ozone and PM." (STAPPA/ALAPCO)
- "Adoption of the proposed regulation ... is necessary for the protection of public health in California and to comply with air quality standards... The need for 15 ppm sulfur diesel fuel cannot be overstated." (California Air Resources Board)
- "The EPA's proposed regulation is necessary if the West is to make reasonable progress towards improving visibility in our nation's Class I areas." (Western Regional Air Partnership (WRAP))
- "Attainment of the NAAQS for ozone and $PM_{2.5}$ is of immediate concern to the states in the northeast region....Thus, programs ... such as the proposed rule for nonroad diesel engines are essential." (NESCAUM)

draft updates of this document released in the past year.[5, 6] EPA's "Health Assessment Document for Diesel Engine Exhaust," (the "Diesel HAD") also reviews health effects information related to diesel exhaust as a whole including diesel PM, which is one component of ambient PM.[7] In the Diesel HAD, we note that the particulate characteristics in the zone around nonroad diesel engines are likely to be substantially the same as published air quality measurements made along busy roadways. This conclusion supports the relevance of health effects associated with highway diesel engine-generated PM to nonroad applications.

As described in these documents, health effects associated with short-term variation in ambient PM have been indicated by epidemiologic studies showing associations between exposure and increased hospital admissions for ischemic heart disease, heart failure, respiratory disease, including chronic obstructive pulmonary disease (COPD) and pneumonia. Short-term elevations in ambient PM have also been associated with increased cough, lower respiratory symptoms, and decrements in lung function. Additional studies have associated changes in heart rate and/or heart rhythm in addition to changes in blood characteristics with exposure to ambient PM. Short-term variations in ambient PM have also been associated with increases in total and cardiorespiratory mortality. Studies examining populations exposed to different levels of air pollution over a number of years, including the Harvard Six Cities Study and the American Cancer Society Study, suggest an association between long-term exposure to ambient $PM_{2.5}$ and premature mortality, including deaths attributed to lung cancer.[8, 9] Two studies further analyzing the Harvard Six Cities Study's air quality data have also established a specific influence of mobile source-related $PM_{2.5}$ on daily mortality and a concentration-response function for mobile source-associated $PM_{2.5}$ and daily mortality. Another recent study in 14 U.S. cities examining the effect of PM_{10} (particulate matter less than 10 microns in diameter) on daily hospital admissions

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[5] U.S. EPA (1996.) Air Quality Criteria for Particulate Matter - Volumes I, II, and III, EPA, Office of Research and Development. Report No. EPA/600/P-95/001a-cF. This material is available electronically at http://www.epa.gov/ttn/oarpg/ticd.html.

[6] U.S. EPA (2003). Air Quality Criteria for Particulate Matter - Volumes I and II (Fourth External Review Draft) This material is available electronically at http://cfpub.epa.gov/ncea/cfm/partmatt.cfm.

[7] U.S. EPA (2002). Health Assessment Document for Diesel Engine Exhaust. EPA/600/8-90/057F Office of Research and Development, Washington DC. This document is available electronically at http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=29060.

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

[9] Pope, CA, III; Burnett, RT; Calle, EE; et al. (2002) Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution. JAMA 287: 1132-1141.

for cardiovascular disease found that the effect of PM_{10} was significantly greater in areas with a larger proportion of PM_{10} coming from motor vehicles, indicating that PM_{10} from these sources may have a greater effect on the toxicity of ambient PM_{10} when compared with other sources.[10]

Of particular relevance to this rule is a recent cohort study which examined the association between mortality and residential proximity to major roads in the Netherlands. Examining a cohort of 55 to 69 year-olds from 1986 to 1994, the study indicated that long-term residence near major roads, an index of exposure to primary mobile source emissions (including diesel exhaust), was significantly associated with increased cardiopulmonary mortality.[11] Other studies have shown children living near roads with high truck traffic density have decreased lung function and greater prevalence of lower respiratory symptoms compared to children living on other roads.[12] A recent review of epidemiologic studies examining associations between asthma and roadway proximity concluded that some coherence was evident in the literature, indicating that asthma, lung function decrement, respiratory symptoms, and other respiratory problems appear to occur more frequently in people living near busy roads.[13] As discussed later, nonroad diesel engine emissions, especially particulate, are similar in composition to those from highway diesel vehicles. Although difficult to associate directly with $PM_{2.5}$, these studies indicate that direct emissions from mobile sources, and diesel engines specifically, may explain a portion of respiratory health effects observed in larger-scale epidemiologic studies. Recent studies conducted in Los Angeles have illustrated that a substantial increase in the concentration of ultrafine particles is evident in locations near roadways, indicating substantial differences in the nature of PM immediately near mobile source emissions.[14] For additional information on health effects, see the RIA.

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[10] Janssen, NA; Schwartz J; Zanobetti A; et al. (2002) Air conditioning and source-specific particles as modifiers of the effect of PM_{10} on hospital admissions for heart and lung disease. Environ Health Perspect 110(1):43-49.

[11] Hoek, G; Brunekreef, B; Goldbohm, S; et al. (2002) Association between mortality and indicators of traffic-related air pollution in the Netherlands: a cohort study. Lancet 360(9341):1203-1209.

[12] Brunekreef, B; Janssen NA; de Hartog, J; et al. (1997) Air pollution from traffic and lung function in children living near motor ways. Epidemiology (8): 298-303.

[13] Delfino RJ. (2002) Epidemiologic evidence for asthma and exposure to air toxics: linkages between occupational, indoor, and community air pollution research. Env Health Perspect Suppl 110(4): 573-589.

[14] Yifang Zhu, William C. Hinds, Seongheon Kim, Si Shen and Constantinos Sioutas Zhu Y; Hinds WC; Kim S; et al. (2002) Study of ultrafine particles near a major highway with heavy-duty diesel traffic. Atmos Environ 36(27): 4323-4335.

In addition to its contribution to ambient PM concentrations, diesel exhaust is of specific concern because it has been judged to pose a lung cancer hazard for humans as well as a hazard from noncancer respiratory effects. In this context, diesel exhaust PM is generally used as a surrogate measure for diesel exhaust. Further, nonroad diesel engine emissions also contain several substances known or suspected as human or animal carcinogens, or that have noncancer health effects as described in the Diesel HAD. Moreover, these compounds have the potential to cause health effects at environmental levels of exposure. These other compounds include benzene, 1,3-butadiene, formaldehyde, acetaldehyde, acrolein, dioxin, and POM. For some of these pollutants, nonroad diesel engine emissions are believed to account for a significant proportion of total nation-wide emissions. All of these compounds were identified as national or regional "risk drivers" in the 1996 NATA.[15] That is, these compounds pose a significant portion of the total inhalation cancer risk to a significant portion of the population. Mobile sources contribute significantly to total emissions of these air toxics. As discussed in more detail in the RIA, this final rulemaking will result in significant reductions of these emissions.

In EPA's Diesel HAD,[16] diesel exhaust was classified as likely to be carcinogenic to humans by inhalation at environmental exposures, in accordance with the revised draft 1996/1999 EPA cancer guidelines. A number of other agencies (National Institute for Occupational Safety and Health, the International Agency for Research on Cancer, the World Health Organization, California EPA, and the U.S. Department of Health and Human Services) have made similar classifications.

EPA generally derives cancer unit risk estimates to calculate population risk more precisely from exposure to carcinogens. In the simplest terms, the cancer unit risk is the increased risk associated with average lifetime exposure of 1 ug/m^3. EPA concluded in the Diesel HAD that it is not possible currently to calculate a cancer unit risk for diesel exhaust due to a variety of factors that limit the current studies, such as lack of an adequate dose-response relationship between exposure and cancer incidence.

However, in the absence of a cancer unit risk, the EPA Diesel HAD sought to provide additional insight into the significance of the cancer hazard by estimating possible ranges of risk that might be present in the population. The possible risk range analysis was developed by comparing a typical environmental exposure level for highway diesel sources to a selected range of occupational exposure levels and then proportionally scaling the occupationally observed risks according to the exposure ratios to obtain an estimate of the possible environmental risk. A

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[15] U.S. EPA (2002). National-Scale Air Toxics Assessment. This material is available electronically at http://www.epa.gov/ttn/atw/nata/.

[16] U.S. EPA (2002). Health Assessment Document for Diesel Engine Exhaust. EPA/600/8-90/057F Office of Research and Development, Washington DC. This document is available electronically at http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=29060.

number of calculations are needed to accomplish this, and these can be seen in the EPA Diesel HAD. The outcome was that environmental risks from diesel exhaust exposure could range from a low of 10^{-4} to 10^{-5} or be as high as 10^{-3} this being a reflection of the range of occupational exposures that could be associated with the relative and absolute risk levels observed in the occupational studies. Because of uncertainties, the analysis acknowledged that the risks could be lower than 10^{-4} or 10^{-5} and a zero risk from diesel exhaust exposure was not ruled out. Although the above risk range is based on environmental exposure levels for highway mobile sources only, the 1996 NATA estimated exposure for nonroad diesel sources as well. Thus, the exposure estimates were somewhat higher than those used in the risk range analysis described above. The EPA Diesel HAD, therefore, stated that the NATA exposure estimates result in a similar risk perspective.

The ozone precursor reductions expected as a result of this rule are also important because of health and welfare effects associated with ozone, as described in the Air Quality Criteria Document for Ozone and Other Photochemical Oxidants. Ozone can irritate the respiratory system, causing coughing, throat irritation, and/or uncomfortable sensation in the chest.[17, 18] Ozone can reduce lung function and make it more difficult to breathe deeply, and breathing may become more rapid and shallow than normal, thereby limiting a person's normal activity. Ozone also can aggravate asthma, leading to more asthma attacks that require a doctor's attention and/or the use of additional medication. In addition, ozone can inflame and damage the lining of the lungs, which may lead to permanent changes in lung tissue, irreversible reductions in lung function, and a lower quality of life if the inflammation occurs repeatedly over a long time period (months, years, a lifetime). People who are of particular concern with respect to ozone exposures include children and adults who are active outdoors. Those people particularly susceptible to ozone effects are people with respiratory disease, such as asthma, and people with unusual sensitivity to ozone, and children. Beyond its human health effects, ozone has been shown to injure plants, which has the effect of reducing crop yields and reducing productivity in forest ecosystems.[19, 20]

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[17] U.S. EPA (1996). Air Quality Criteria for Ozone and Related Photochemical Oxidants, EPA/600/P-93/004aF. Docket No. A-99-06. Document Nos. II-A-15 to 17.

[18] U.S. EPA. (1996). Review of National Ambient Air Quality Standards for Ozone, Assessment of Scientific and Technical Information, OAQPS Staff Paper, EPA-452/R-96-007. Docket No. A-99-06. Document No. II-A-22.

[19] U.S. EPA (1996). Air Quality Criteria for Ozone and Related Photochemical Oxidants, EPA/600/P-93/004aF. Docket No. A-99-06. Document Nos. II-A-15 to 17.

[20] U.S. EPA. (1996). Review of National Ambient Air Quality Standards for Ozone, Assessment of Scientific and Technical Information, OAQPS Staff Paper, EPA-452/R-96-007. Docket No. A-99-06. Document No. II-A-22.

New research suggests additional serious health effects beyond those that were known when the 8-hour ozone health standard was set. Since 1997, over 1,700 new health and welfare studies relating to ozone have been published in peer-reviewed journals.[21] Many of these studies investigate the impact of ozone exposure on such health effects as changes in lung structure and biochemistry, inflammation of the lungs, exacerbation and causation of asthma, respiratory illness-related school absence, hospital and emergency room visits for asthma and other respiratory causes, and premature mortality. EPA is currently evaluating these and other studies as part of the ongoing review of the air quality criteria and NAAQS for ozone. A revised Air Quality Criteria Document for Ozone and Other Photochemical Oxidants will be prepared in consultation with EPA's Clean Air Science Advisory Committee (CASAC). Key new health information falls into four general areas: development of new-onset asthma, hospital admissions for young children, school absence rate, and premature mortality. In all, the new studies that have become available since the 8-hour ozone standard was adopted in 1997 continue to demonstrate the harmful effects of ozone on public health and the need for areas with high ozone levels to attain and maintain the NAAQS.

Finally, nonroad diesel emissions contribute to nine categories of non-health impacts: visibility impairment, soiling and material damage, acid deposition, eutrophication of water bodies, plant and ecosystem damage from ozone, water pollution resulting from deposition of toxic air pollutants with resulting effects on fish and wildlife, and odor. In particular, EPA determined that nonroad engines contribute significantly to unacceptable visibility conditions where people live, work and recreate, including contributing to visibility impairment in Federally mandated Class I areas that are given special emphasis in the Clean Air Act (67 FR 68242, November 8, 2002). Visibility is impaired by fine PM and precursor emissions from nonroad diesel engines subject to this final rule. Reductions in emissions from this final rule will improve visibility as well as other environmental outcomes as described in the RIA.

As supplementary information, we have made estimates using air quality modeling to illustrate the types of change in future $PM_{2.5}$ and ozone levels that we would expect to result from a final rule like this as described in chapter 2 of the RIA. That modeling shows that control of nonroad emissions would produce nationwide air quality improvements in $PM_{2.5}$ and ozone levels as well as visibility improvements. On a population-weighted basis, the average modeled change in future-year $PM_{2.5}$ annual averages is projected to decrease by 0.42 $\mu g/m^3$ (3.3%) in 2020, and 0.59 $\mu g/m^3$ (0.6%) in 2030. In addition, the population-weighted average modeled change in future year design values for ozone would decrease by 1.8 parts per billion (ppb) in 2020, and 2.5 ppb in 2030. Within areas predicted to violate the ozone NAAQS in the projected

[21] New Ozone Health and Environmental Effects References, Published Since Completion of the Previous Ozone AQCD, National Center for Environmental Assessment, Office of Research and Development, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711 (7/2002) Docket No. A-2001-28, Document II-A-79.

base case, the average decrease would be somewhat higher: 1.9 ppb in 2020 and 3.0 ppb in 2030.

The PM air quality improvements expected from this final rule are anticipated to produce major benefits to human health and welfare, with a combined value in excess of half a trillion dollars between 2007 and 2030. For example, in 2030, we estimate that this program will reduce approximately 129,000 tons $PM_{2.5}$ and 738,000 tons of NO_X. The resulting ambient PM reductions correspond to public health improvements in 2030, including 12,000 fewer premature mortalities, 15,000 fewer heart attacks, 200,000 fewer asthma exacerbations in children, and 1 million fewer days when adults miss work due to their respiratory symptoms, and 5.9 million fewer days when adults have to restrict their activities due to respiratory symptoms. The reductions will also improve visibility and reduce diesel odor. For further details on the economic benefits of this rule, please refer to the benefit-cost discussion in section VI of this preamble and chapter 9 of the RIA.

b. Emissions From Nonroad Diesel Engines

The engine and fuel standards in this final rule will affect emissions of direct $PM_{2.5}$, SO_2, NO_X, VOCs, and air toxics for land-based nonroad diesel engines.[22] For locomotive, commercial marine vessel (CMV), and recreational marine vessel (RMV) engines, the final fuel standards will affect direct $PM_{2.5}$ and SO_2 emissions. Each sub-section below discusses one of these pollutants,[23] including expected emission reductions associated with the final standards.[24] Table I.B-1 summarizes the impacts of this rule for 2020 and 2030. Further details on our inventory estimates, including results for other years, are available in chapter 3 of the RIA.

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[22] We are also adopting a few minor adjustments of a technical nature to current CO standards. Emissions effects from these standards are discussed in the RIA.

[23] The estimates of baseline emissions and emissions reductions from the final rule reported here for nonroad land-based, recreational marine, locomotive, and commercial marine vessel diesel engines are based on 50 state emissions inventory estimates. A 48 state inventory was used for air quality modeling that EPA conducted for this rule, of which Alaska and Hawaii are not a part. In cases where land-based nonroad diesel engine emissions are compared with non-mobile source portions of the inventory, we use a 48 state emissions inventory, to match the 48 state nature of those other inventories.

[24] Please see the Summary and Analyses of Comments document for discussions of issues raised about the emission inventory estimates during the comment period for the NPRM.

Table I.B-1. – Estimated National (50 State) Reductions in Emissions From Nonroad Land-Based, Locomotive, Commercial Marine, and Recreational Marine Diesel Engines

Pollutant [short tons]	2020	2030
Direct $PM_{2.5}$		
$PM_{2.5}$ Emissions Without Rule	167,000	181,000
$PM_{2.5}$ Emissions With 500 ppm Sulfur in 2007 and No Other Controls	144,000	155,000
$PM_{2.5}$ Emissions With 15 ppm Sulfur in 2012 and No Other Controls	141,000	152,000
$PM_{2.5}$ Emissions With Entire Rule	81,000	52,000
$PM_{2.5}$ Reductions Resulting from this Rule	**86,000**	**129,000**
SO_2		
SO_2 Emissions Without Rule	326,000	379,000
SO_2 Emisions With 500 ppm Sulfur in 2007	37,000	43,000
SO_2 Emissions With Entire Rule (15 ppm Sulfur in 2012)	3,000	3,000
SO_2 Reductions Resulting from this Rule	**323,000**	**376,000**
NO_X - Land-Based Nonroad Engines Only[a]		
NO_X Emissions Without Rule	1,125,000	1,199,000
NO_X Emissions With Rule	681,000	461,000
NO_X Reductions Resulting from this Rule	**444,000**	**738,000**
VOC - Land-Based Nonroad Engines Only[a]		
VOC Emissions Without Rule	98,000	97,000
VOC Emissions With Rule	75,000	63,000
VOC Reductions Resulting from this Rule	**23,000**	**34,000**

Notes: [a] NO_X and VOC numbers only include emissions for land-based nonroad diesel engines because the Tier 4 controls will not be applied to locomotive, commercial marine, and recreational marine engines; and no NO_X and VOC emission reductions are generated through the lowering of fuel sulfur levels.

i. Direct $PM_{2.5}$

As described earlier, the Agency believes that reductions of diesel $PM_{2.5}$ emissions are needed as part of the nation's progress toward clean air. Direct $PM_{2.5}$ emissions from land-based nonroad diesel engines amount to increasingly large percentages of total man-made diesel $PM_{2.5}$. Between 1996 and 2030, we estimate that the percentage of total man-made diesel $PM_{2.5}$

emissions coming from land-based nonroad diesel engines will increase from about 46 percent to 72 percent (based on a 48 state inventory).

Emissions of direct $PM_{2.5}$ from land-based nonroad diesel engines based on a 50 state inventory are shown in table I.B-1, along with our estimates of the reductions in 2020 and 2030 we expect would result from our final rule for a $PM_{2.5}$ exhaust emission standard and from changes in the sulfur level in land-based nonroad, locomotive, and marine diesel fuel. Land-based nonroad, locomotive, and marine diesel fuel sulfur levels will be lowered to about 340 ppm in-use (500 ppm maximum) in 2007. Land-based nonroad diesel fuel sulfur will be lowered further to about 11 ppm in-use (15 ppm maximum) in 2010 and locomotive and marine diesel fuel sulfur will be lowered to the same level in 2012. In addition to $PM_{2.5}$ emissions estimates with the final rule, emissions estimates based on lowering diesel fuel sulfur without any other controls are shown in table I.B-1 for 2020 and 2030.

Figure I.B-1a shows our estimate of $PM_{2.5}$ emissions between 2000 and 2030 both without and with the final standards and fuel sulfur requirements of this rule. We estimate that $PM_{2.5}$ emissions from this source would be reduced by 71 percent in 2030.

ii. *SO_2*

We estimate that land-based nonroad, CMV, RMV, and locomotive diesel engines emitted about 234,000 tons of SO_2 in 1996, accounting for about 33 percent of the SO_2 from mobile sources (based on a 48 state inventory). With no reduction in diesel fuel sulfur levels, we estimate that these emissions will continue to increase, accounting for about 44 percent of mobile source SO_2 emissions by 2030.

As part of this final rule, sulfur levels in fuel will be significantly reduced, leading to large reductions in nonroad, locomotive, and marine diesel SO_2 emissions. By 2007, the sulfur in diesel fuel used by all land-based nonroad, locomotive, and marine diesel engines will be reduced from the current average in-use level of between 2,300 to 2,400 ppm[25] to an average in-use level of about 340 ppm, with a maximum level of 500 ppm. By 2010, the sulfur in diesel fuel used by land-based nonroad engines will be reduced to an average in-use level of 11 ppm with a maximum level of 15 ppm. Sulfur in diesel fuel used by locomotive and marine engines will be reduced to the same level by 2012. Table II.B-1 and figure II.B-1b show the estimated reductions from these sulfur changes.

[25] Highway fuel is currently used in a significant fraction of land based nonroad equipment, locomotives, and marine vessels, reducing the in-use average sulfur level from about 3,000 ppm for uncontrolled high-sulfur fuel to 2,300 or 2,400 ppm.

iii. NO_X

Table I.B-1 shows the 50 state estimated tonnage of NO_X emissions for 2020 and 2030 without the final rule and the estimated tonnage of emissions eliminated with the final rule in place. These results are shown graphically in Figure I.E-1c at the end of this section. We estimate that NO_X emissions from these engines will be reduced by 62 percent in 2030.

We note that the magnitude of NO_X reductions determined in the final rule analysis is somewhat less than what was reported in the proposal's preamble and RIA, especially in the later years when the fleet has mostly turned over to Tier 4 designs. The greater part of this is due to the fact that we have deferred setting a long-term NO_X standard for mobile machinery over 750 horsepower to a later action. When this future action is completed, we would expect roughly equivalent reductions between the proposal and the overall final program, though there are some other effects reflected in the differing NO_X reductions as well, due to updated modeling assumptions and the adjusted NO_X standards levels for engines over 750 horsepower. Section II.A.4 of this preamble contains a detailed discussion of the NO_X standards we are adopting for engines over 750 horsepower as well as the basis for those standards.

iv. VOCs and Air Toxics

Based on a 48 state emissions inventory, we estimate that land-based nonroad diesel engines emitted over 221 thousand tons of VOC in 1996. Between 1996 and 2030, we estimate that land-based nonroad diesel engines will contribute about 2 to 3 percent of mobile source VOC emissions. Without further controls, land-based nonroad diesel engines will emit about 97 thousand tons/year of VOC in 2020 and 2030 nationally.

Table I.B-1 shows our projection of the reductions in 2020 and 2030 for VOC emissions that we expect from implementing the final NMHC standards. This estimate is based on a 50 state emissions inventory. By 2030, VOC emissions from this category would be reduced by 35 percent from baseline levels.

While we are not adopting any specific gaseous air toxics standards in today’s rule, air toxics emissions would nonetheless be significantly reduced through the NMHC standards included in the final rule. By 2030, we estimate that emissions of air toxics pollutants, such as benzene, formaldehyde, acetaldehyde, 1,3-butadiene, and acrolein, would be reduced by 35 percent from land-based nonroad diesel engines. Diesel PM reductions were discussed above. For specific air toxics reduction estimates, see chapter 3 of the RIA.

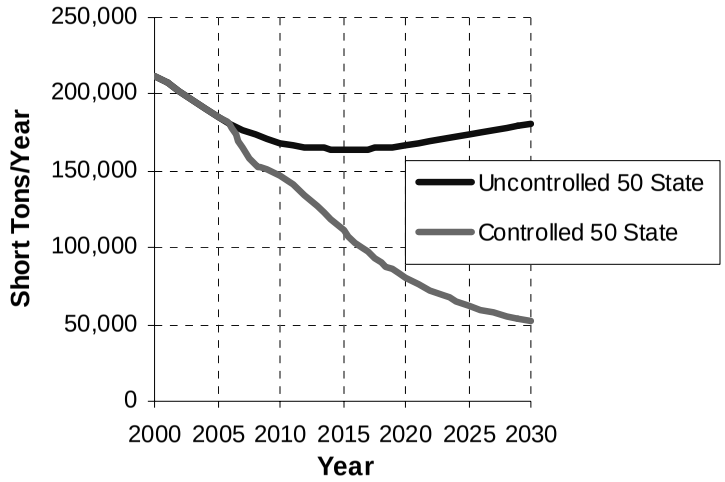

Figure I.B-1a: Estimated $PM_{2.5}$ Reductions From Nonroad Land-Based Diesel Engine Standard and Diesel Fuel Sulfur Reductions

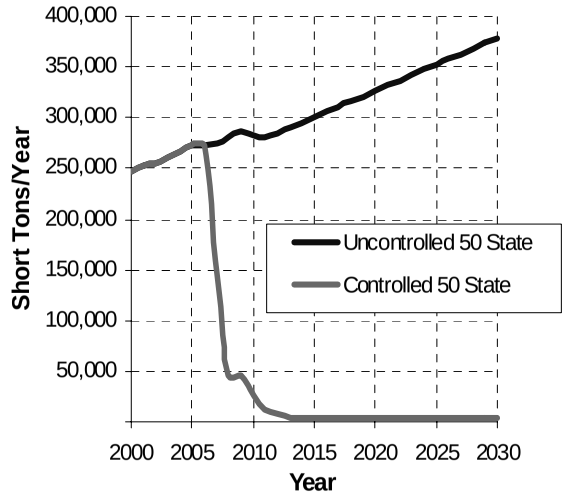

Figure I.B-1b: Estimated SO_2 Reductions From Lowering Diesel Fuel Sulfur For Land-Based Nonroad Engines, CMVs, RMVs, and Locomotives

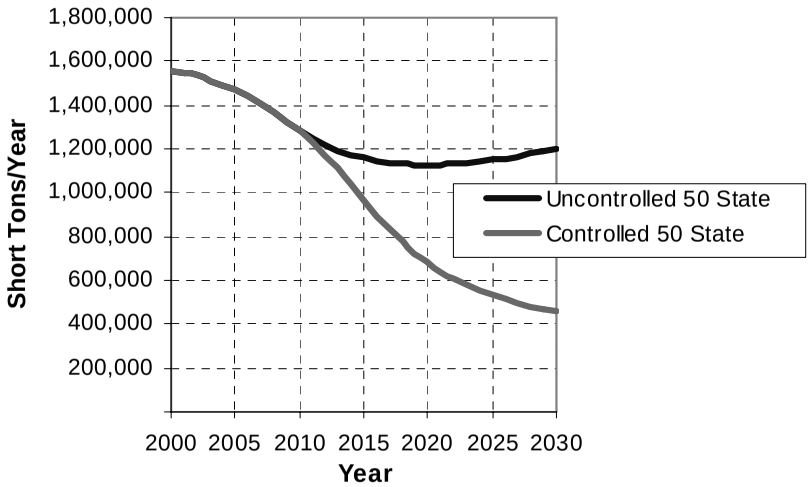

Figure I.B-1c: Estimated NOx Reductions From Land-Based Nonroad Diesel Engine Standard

II. Nonroad Engine Standards

In this section we describe the emission standards for nonroad diesel engines that we are setting to address the serious air quality problems discussed in section I. These Tier 4 standards, which take effect starting in 2008, are very similar to those proposed, and obtain very similar emissions reductions. The long-term PM filter-based standards that apply to all engines over 25 hp, combined with the fuel change and new requirements to ensure robust control in the field, will yield PM reductions of over 95% from the in-use levels of

today's cleanest Tier 2 engines. Likewise, the long-term NO_X standards we are adopting for nearly all engines above 75 hp will yield NO_X reductions of about 90% from the NO_X levels expected from even the low-emitting Tier 3 engines due to first reach the market in 2006 or later. The Tier 4 standards will bring about large reductions in toxic hydrocarbon emissions as well.

In this final rule we are largely adopting the standards and timing we proposed, with the exception of those that apply to engines over 750 hp. We restructured and modified the standards and timing for these engines to address technical concerns and to focus on achieving comparable emission reductions through the introduction of advanced technology as early as feasible from specific applications within this power category. See section II.A.4 for a detailed discussion. We also are not adopting the proposed minor adjustments to the CO standard levels for some engines under 75 hp, as explained in section II.A.6. In addition, there are minor changes from the proposal in the phase-in approach we are adopting for NO_X and NMHC standards, as detailed in this section.

In this section we discuss:

- The Tier 4 engine standards, and the schedule for implementing them;
- The feasibility of the Tier 4 standards (in conjunction with the low-sulfur nonroad diesel fuel requirement discussed in section IV); and
- How diesel fuel sulfur affects an engine's ability to meet the new standards.

Additional provisions for engine and equipment manufacturers are discussed in detail in section III. These include:

- The averaging, banking, and trading (ABT) program.
- The transition program for equipment manufacturers.
- The addition of a "not-to-exceed" program to ensure in-use emissions control. This program includes new emission standards and related test procedures to supplement the standards discussed in this section.
- The test procedures and other compliance requirements associated with the emission standards.
- Special provisions to aid small businesses in implementing our requirements.
- An incentive program to encourage innovative technologies and the early introduction of new technologies.

A. What Are the New Engine Standards?

The Tier 4 exhaust emissions standards for PM, NO_X, and NMHC are summarized in tables II.A-1, 2, and 4.[26] Crankcase emissions control requirements are discussed in section

[26] Consistent with past EPA rulemakings for nonroad diesel engines, our regulations express standards, power ratings, and other quantities in international SI (metric) units--kilowatts, gram per

II.A.7. Previously adopted CO emission standards continue to apply as well. All of these standards apply to covered nonroad engines over the useful life periods specified in our regulations, except where temporary in-use compliance margins apply as discussed in section III.E. To help ensure that these emission reductions will be achieved in use, we have adopted test procedures for measuring compliance with these standards tailored to both steady-state and transient nonroad engine operating characteristics. These test procedures are discussed in several subsections of section III. Another component of our program to ensure control of emissions in-use is the new "not-to-exceed" (NTE) emission standards and associated test procedures, discussed in section III.J.

Table II.A-1. – Tier 4 PM Standards (g/bhp-hr) and Schedule

Engine Power	Model Year					
	2008	2009	2010	2011	2012	2013
hp < 25 (kW < 19)	0.30 [a]					
25 ≤ hp < 75 (19 ≤ kW < 56)	0.22 [b]					0.02
75 ≤ hp < 175 (56 ≤ kW < 130)					0.01	
175 ≤ hp ≤ 750 (130 ≤ kW ≤ 560)				0.01		
hp 750 (kW > 560)	see table II.A-4					

Notes:

[a] For air-cooled, hand-startable, direct injection engines under 11 hp, a manufacturer may instead delay implementation until 2010 and demonstrate compliance with a less stringent PM standard of 0.45 g/bhp-hr, subject also to additional provisions discussed in section II.A.3.a.

[b] A manufacturer has the option of skipping the 0.22 g/bhp-hr PM standard for all 50-75 hp engines. The 0.02 g/bhp-hr PM standard would then take effect one year earlier for all 50-75 hp engines, in 2012.

kilowatt-hour, etc. This aids in achieving harmonization with standards-setting bodies outside the U.S., and in laboratory operations in which these units are the norm. However, in this preamble and in other rulemaking documents for the general reader, we have chosen to use terms more common in general usage in the U.S. Hence standards are expressed in units of grams per brake horsepower-hour, power ratings in horsepower, etc. In any compliance questions that might arise from differences in these due to, for example, rounding conventions, the regulations themselves establish the applicable requirements.

Table II.A-.2 – Tier 4 NO_X and NMHC Standards and Schedule

Engine Power	Standard (g/bhp-hr)		Phase-in Schedule (model year)			
	NO_X	NMHC	2011	2012	2013	2014
25 ≤ hp < 75 (19 ≤ kW < 56)	3.5 NMHC+NO_X [a]				100%	
75 ≤ hp < 175 (56 ≤ kW < 130)	0.30	0.14		50% [b]	50% [b]	100% [b]
175 ≤ hp ≤ 750 (130 ≤ kW ≤ 560)	0.30	0.14	50%	50%	50%	100%
hp > 750 (kW > 560)	see table II.A-4					

Notes: Percentages indicate production required to comply with the Tier 4 standards in the indicated model year.

[a] This is the existing Tier 3 combined NMHC+NO_X standard level for the 50-75 hp engines in this category. In 2013 it applies to the 25-50 hp engines as well.

[b] Manufacturers may use banked Tier 2 NMHC+NO_X credits from engines at or above 50 hp to demonstrate compliance with the 75-175 hp engine NO_X standard in this model year. Alternatively, manufacturers may forego this special banked credit option and instead meet an alternative phase-in requirement of 25/25/25% in 2012, 2013, and 2014 through December 30, with 100% compliance required beginning December 31, 2014. See sections III.A and II.A.2.b.

The long-term 0.01 and 0.02 g/bhp-hr Tier 4 PM standards for 75–750 hp and 25–75 hp engines, respectively, combined with the fuel change and new requirements to ensure robust control in the field, represent a reduction of over 95% from in-use levels expected with Tier 2/Tier 3 engines.[27] The 0.30 g/bhp-hr Tier 4 NO_X standard for 75–750 hp engines represents a NO_X reduction of about 90% from in-use levels expected with Tier 3 engines. Emissions reductions from engines over 750 hp are discussed in section II.A.4.

In general, there was widespread support in the comments for the proposed Tier 4 engine standards and for the timing we proposed for them. Some commenters raised category-specific concerns, especially for the smaller and the very large engine categories. These comments are discussed below.

[27] Note that we are grouping all standards in this rule, including those that take effect in 2008, under the general designation of "Tier 4 standards." As a result, there are no "Tier 3" standards in the multi-tier nonroad program for engines below 50 hp or above 750 hp.

1. Standards Timing

a. 2008 Standards

The timing of the Tier 4 engine standards is closely tied to the timing of fuel quality changes discussed in section IV, in keeping with the systems approach we are taking for this program. The earliest Tier 4 engine standards take effect in model year 2008, in conjunction with the introduction of 500 ppm maximum sulfur nonroad diesel fuel in mid-2007. This fuel change serves a dual environmental purpose. First, it provides a large immediate reduction in PM and SO_X emissions for the existing fleet of engines in the field. Second, its widespread availability by the end of 2007 aids engine designers in employing emissions controls capable of achieving the Tier 4 standards for model year 2008 and later engines; this is because the performance and durability of such technologies as exhaust gas recirculation (EGR) and diesel oxidation catalysts is improved by lower sulfur fuel.[28] The reduction of sulfur in nonroad diesel fuel will also provide sizeable economic benefits to machine operators as it will reduce wear and corrosion and will allow them to extend oil change intervals (see section VI.B). These economic benefits will occur for all diesel engines using the new fuel, not just for those built in 2008 or later.

As we proposed, these 2008 Tier 4 engine standards apply only to engines below 75 hp. We are not setting Tier 4 standards taking effect in 2008 for larger engines. The reasons for this differ depending on the engines' hp rating. Setting Tier 4 2008 standards for engines at or above 100 hp would provide an insufficient period of stability (an element of lead time) between Tier 2/3 and Tier 4, and so would not be appropriate. This is because these engines become subject to existing Tier 2 or 3 NMHC+NO_X standards in 2006 or 2007. Setting new 2008 standards for them thus would provide only one or two years of Tier 2/Tier 3 stability before another round of design changes would have to be made in 2008 for Tier 4.

It is also inappropriate to establish 2008 Tier 4 standards for engines of 75–100 hp. The stability issue just noted for larger engines is not present for these engines, because these engines are subject to Tier 3 NMHC+NO_X standards starting in 2008, so that our setting a Tier 4 PM standard for them in the same year would not create the situation in which engines have to be redesigned twice to comply with new standards within a space of one or two years. However, EPA believes the more significant concern for these engines is meeting the stringent aftertreatment-based standards for PM and NO_X in 2012. We are concerned that adopting interim 2008 standards for these engines would divert resources needed to achieve these 2012 standards and indeed jeopardize attaining them. Thus, although early emission reductions from these engines in 2008 would of course be desirable, we felt that the focus we are putting on obtaining much larger reductions from them in 2012, together with the fact that we already have a Tier 3

[28] "Nonroad Diesel Emissions Standards Staff Technical Paper," EPA420-R-01-052, October 2001.

NMHC+NO_X standard taking effect for 75–100 hp engines in 2008, warrants our not adding additional control requirements for these engines during this interim period.

We note that the 50-75 hp engines also have a Tier 3 NMHC+NO_X standard taking effect in 2008 and, as noted above, we *are* setting a new Tier 4 2008 PM standard for them. Unlike the larger 75–100 hp engines, however, the 50-75 hp engines have one additional year, until 2013, before filter-based PM standards take effect, and also have no additional NO_X control requirement being set beyond the 2008 Tier 3 standard. These differences justify including the interim Tier 4 PM standard for these engines. We note too that achieving the 2008 PM standard is enabled in part by the large reduction in certification fuel sulfur that applies in 2008 (see section III.D). Fuel sulfur has a known correlation to PM generation, even for engines without aftertreatment. Moreover, for any manufacturers who believe that accomplishing this PM pull-ahead will hamper their Tier 3 compliance efforts for these engines, there is an alternative Tier 4 compliance option. Instead of meeting new Tier 4 PM standards in both 2008 and 2013, manufacturers may skip the Tier 4 2008 PM standard, and instead focus design efforts on introducing PM filters for these engines one year earlier, by complying with the aftertreatment-based standard for PM in 2012. These options are discussed in more detail in section II.A.3.b.

We view the 2008 portion of the Tier 4 program as highly important because it provides substantial PM and SO_X emissions reductions during the several years prior to 2011. Initiating Tier 4 in 2008 also fits well with the lead time (including stability), cost, and technology availability considerations of the overall program. Initiating the Tier 4 engine standards in 2008 provides three to four years of stability after the start of Tier 2 for engines under 50 hp. As mentioned above, it also coincides with the start date of Tier 3 NMHC+NO_X standards for 50–75 hp engines and so introduces no stability issues for these engines (as redesign for both PM and NO_X occurs at the same time). The 2008 start date provides almost 4 years of lead time to accomplish redesign and testing. The evolutionary character of the 2008 standards, based as they are on proven technologies, and the fact that some certified engines already meet these standards as discussed in section II.B, leads us to conclude that the standards are appropriate within the meaning of section 213(a)(4) of the Clean Air Act and that we are providing adequate lead time to achieve those standards.

Engine and equipment manufacturers argued in their comments that the PM pull-ahead option for 50–75 hp engines is inappropriate because it constitutes a re-opening of the Tier 3 rule, involving as it does a Tier 4 PM standard in 2008, the same year that the Tier 3 NMHC+NO_X takes effect. They further argued that the non-pull-ahead option is not a real option because PM aftertreatment cannot be implemented for these engines in 2012.

We disagree with both contentions. We determined, as part of our feasibility analysis for Tier 4, that it is feasible to design engines to meet the 2008 PM standard in the same year that a Tier 3 NMHC+NO_X standard takes effect. See section II.B and RIA sections 4.1.4 and 4.1.5. One reason is that a substantial part of the 2008 PM emission reductions do not result from engine redesign, but rather are due to the reduction in certification test fuel maximum sulfur

levels from 2000 to 500 ppm that results from the fuel change in the field. This reduction in sulfur levels also aids engine designers in employing emission control technologies that are detrimentally affected by sulfur, not only for PM control, but also for NMHC and NO_X control. Examples of these sulfur-sensitive technologies are oxidation catalysts, which can substantially reduce PM and NMHC, and EGR, which is effective at reducing NO_X. We note further that designing engines to meet the 2008 PM standard is also made less difficult by our not requiring engine designers to consider the transient test, cold start, and not-to-exceed requirements that are otherwise part of the Tier 4 program. These requirements do not take effect for these engines until the 0.02 g/bhp-hr standard is implemented in 2012 or 2013. See section III.F for details.

We also believe that the second option (compliance with the aftertreatment-based PM standard in 2012, with no interim 2008 standard) is viable, and may be an attractive choice especially for engine families on the higher side of the 50-75 hp range that share a design platform with larger engines being equipped with PM filters to meet the Tier 4 standard for 75–175 hp engines in 2012. We believe 75 hp is the appropriate cutpoint for setting and timing emissions standards (see section II.A.5), but it obviously is not a hard-and-fast separator between engine platforms for all manufacturers in all product lines. Even for many 50–75 hp engines that do not share a design platform with larger engines, we believe that a 2012 implementation date for PM filter technology may be practical, considering the 4-year lead time it affords after Tier 3 begins for these engines (in 2008), 8-year lead time after the last PM standard change (in 2004), and 5-year lead time after full-scale PM filter technology implementation on highway engines (in 2007).

Engine manufacturers also commented that the two-options approach would cause their customers to switch engine suppliers in 2012 to get the least expensive engines possible in every year, thus compromising the environmental objectives and creating market disruptions. We have addressed these concerns as discussed in section II.A.3.b.

b. 2011 and Later Standards

The second fuel change for nonroad diesel fuel, to 15 ppm maximum sulfur in mid-2010, and the related engine standards for PM, NO_X, and NMHC that begin to phase-in in the 2011 model year, provide most of the environmental benefits of the program. Like the 2008 standards, these standards are timed to provide adequate lead time for engine and equipment manufacturers. They also are phased in over time to allow for the orderly transfer of technology from the highway sector, and to spread the overall workload for engine and equipment manufacturers engaged in redesigning a large number and variety of products for Tier 4.

As we explained at proposal, we believe that the high-efficiency exhaust emission control technologies being developed to meet our 2007 emission standards for heavy-duty highway diesel engines can be adapted to most nonroad diesel applications. The engines for which we believe this adaptation from highway applications will be most straightforward are those in the 175–750 hp power range, and thus these engines are subject to new standards requiring high-

efficiency exhaust emission controls as soon as the 15 ppm sulfur diesel fuel is widely available, that is, in the 2011 model year. Engines of 75–175 hp are subject to the new standards in the following model year, 2012, reflecting the need to spread the redesign workload and, to some extent, the greater effort that may be involved in adapting highway technologies to these engines. Engines between 25 and 75 hp are subject to new standards for PM based on high-efficiency exhaust emission controls in 2013, reflecting again the need to spread the workload and the challenge of adapting this technology to these engines which typically do not have highway counterparts. Engines over 750 hp involve a number of special considerations, necessitating an implementation approach unique to these engines as explained in section II.A.4. Lastly , there are additional provisions discussed in sections III.B.2 and III.M to encourage early technology introduction and to further draw from the highway technology experience.

This approach of implementing Tier 4 standards by power category over 2011–2013 provides for the orderly migration of technology and distribution of redesign workload over three model years, as EPA provided in Tier 3. Overall, this approach provides 4 to 6 years of real world experience with the new technology in the highway sector, involving millions of engines (in addition to the several additional years provided by demonstration fleets on the road in earlier years), before the new standards take effect. We consider the implementation of Tier 4 standard start dates over 2011–2013 as described above to be responsive to the technology migration and workload distribution concerns.

2. Phase-In of NO_X and NMHC Standards for 75–750 hp Engines

a. Percent-of-Production Phase-In for NO_X and NMHC

We are finalizing the percent-of-production phase-in for NO_X and NMHC that we proposed for 75–750 hp engines. Because Tier 4 NO_X emissions control technology is expected to be derived from technology first introduced in highway heavy-duty diesels, we proposed to adopt the implementation pattern for the Tier 4 NO_X standard which we adopted for the heavy-duty highway diesel program. This will help to ensure a focused, orderly development of robust high-efficiency NO_X control in the nonroad sector and will also help to ensure that manufacturers are able to take maximum advantage of the highway engine development program, with resulting cost savings.

The heavy-duty highway rule allows for a gradual phase-in of the NO_X and NMHC requirements over multiple model years: 50% of each manufacturer's U.S.-directed production volume must meet the new standard in 2007-2009, and 100% must do so by 2010. Through the use of emissions averaging, this phase-in approach also provides the flexibility for highway engine manufacturers to meet that program's environmental goals by allowing somewhat less-efficient NO_X controls on more than 50% of their production during the 2007–2009 phase-in years.

We follow the same pattern in this rule. As proposed, we are phasing in the NO_X standards for nonroad diesels over 2011–2013 as indicated in table II.A-2, based on compliance with the Tier 4 standards for 50% of a manufacturer's U.S.-directed production in each power category between 75 and 750 hp in each phase-in model year. The phase-in of standards for engines over 750 hp is discussed in section II.A.4. With a NO_X phase-in, all manufacturers are able to introduce their new technologies on a limited number of engines, thereby gaining valuable experience with the technology prior to implementing it on their entire product line. In tandem with the equipment manufacturer transition program discussed in section III.B, the phase-in ensures timely progress to the Tier 4 standard levels while providing a great degree of implementation flexibility for the industry.

This "percent of production phase-in" is intended to take maximum advantage of the highway program technology development. It adds a new dimension of implementation flexibility to the staggered "phase-in by power category" used in the nonroad program for Tiers 1–3 (and also in this Tier 4) which, though structured to facilitate technology development and transfer, is more aimed at spreading the redesign workload. Because the Tier 4 program involves challenges in addressing both technology development and redesign workload, we believe that incorporating both of these phase-in mechanisms into the program is warranted, resulting in the coordinated phase-in plan shown in table II.A-2, which we are finalizing essentially as proposed. Note that this results in the new NO_X requirements for 75–175 hp engines taking effect starting in the second year of the 2011-2013 general phase-in, in effect creating a 50-50% phase-in in 2012–2013 for this category. This then staggers the Tier 4 start years by power category as in past tiers: 2011 for engines at or above 175 hp, 2012 for 75–175 hp engines, and 2013 for 25–75 hp engines (for which no NO_X adsorber-based standard and thus no percentage phase-in is being adopted), while still providing a production-based phase-in for advanced NO_X control technologies.

Comments from the States and environmental organizations argued for the completion of the phase-in by the end of 2012, contending that technology progress for NO_X control in the highway sector has been good to date and would support an accelerated phase-in in the nonroad sector. However, our assessment continues to show unique (though surmountable) challenges in adapting advanced technologies to nonroad engines, especially for engines least like highway diesels, and it is these engines that would be most affected by a truncated phase-in schedule. Furthermore, even if we were to conclude that advanced technologies will be ready earlier than expected, we would not be able to move up the start of phase-in dates because these dates also depend on low-sulfur fuel availability. Thus an end-of-2012 phase-in completion date would result in phase-ins as short as one year, thus degrading the industry's opportunity to distribute the redesign workload and departing from the pattern set by the highway program. Both of these are critical factors in our assessment that the proposed engine standards are feasible, and so a change to shorter phase-ins would jeopardize achievement of our environmental objectives for nonroad diesels. Therefore we are not adopting the suggested earlier completion of the phase-in.

As proposed, we are phasing in the Tier 4 NMHC standard for 75–750 hp engines with the NO_X standard, as is being done in the highway program. Engines certified to the new NO_X requirement would be expected to certify to the NMHC standard as well. The "phase-out" engines (those not certified to the new Tier 4 NO_X and NMHC standards) would continue to be certified to the applicable Tier 3 NMHC+NO_X standard. As discussed in section II.B, we believe that the NMHC standard is readily achievable through the application of PM traps to meet the PM standard, which does not involve such a phase-in. However, in the highway program we chose to phase in the NMHC standard with the NO_X standard to simplify the phase-in under the percent-of-production approach taken there, thus avoiding subjecting the "phase-out" engines to separate standards for NMHC and NMHC+NO_X (which could lead to increased administrative costs with essentially no different environmental result). The same reasoning applies here because, as in the highway program, the previous-tier standards are combined NMHC+NO_X standards. No commenters objected to this approach.

Because of the tremendous variety of engine sizes represented in the nonroad diesel sector, we are finalizing our proposed requirement that the phase-in requirement be met separately in both of the power categories with a phase-in (75–175 hp and 175–750 hp).[29] For example, a manufacturer that produces 1000 engines for the 2011 U.S. market in the 175 to 750 hp range would have to demonstrate compliance with the NO_X and NMHC standards on at least 500 of these engines, regardless of how many complying engines the manufacturer produces in the 75–175 hp category. (Note however that we are allowing averaging of emissions between these engine categories through the use of power-weighted ABT program credits.) We believe that this restriction reflects the availability of emissions control technology, and is needed to avoid erosion of environmental benefits that might occur if a manufacturer with a diverse product offering were to meet the phase-in with relatively low cost smaller engines, thereby delaying compliance on larger engines with much higher lifetime emissions potential. Even so, the horsepower ranges for these power categories are fairly broad, so this restriction allows ample freedom to manufacturers to structure compliance plans in the most cost-effective manner. There were no adverse comments on this approach.

b. Special Considerations for the 75–175 hp Category

As discussed in the proposal, the 75–175 hp category of engines and equipment may involve added workload challenges for the industry to develop and transfer technology. Though spanning only 100 hp, this category represents a great diversity of applications, and comprises a disproportionate number of the total nonroad engine and machine models. Some of these engines, though having characteristics comparable to many highway engines such as turbocharging and electronic fuel control, are not directly derived from highway engine platforms

[29] Note exceptions to the percent phase-in requirements during the phase-in model years discussed in sections III.L and III.M. These deal with differences between a manufacturer's actual and projected production levels, and with incentives for early or very low emission engine introductions.

and so are likely to require more development work than larger engines to transfer emission control technology from the highway sector. Furthermore, the engine and equipment manufacturers have greatly varying market profiles in this category, from focused one- or two-product offerings to very diverse product lines with a great many models.

Therefore, in addition to the flexibility provided through the phase-in mechanism, we proposed two optional measures to provide added flexibility in implementing the Tier 4 NO_X standards, while keeping a priority on bringing PM emissions control into this diverse power category as quickly as possible. First, we proposed to allow manufacturers to use NMHC+NO_X credits generated by any Tier 2 engines over 50 hp (in addition to any other allowable credits) to demonstrate compliance with the Tier 4 requirement for 75–175 hp engines in 2012, 2013, and 2014 only. Second, we proposed allowing a manufacturer to instead demonstrate compliance with a reduced phase-in requirement of 25% for NO_X and NMHC in each of 2012, 2013, and the first 9 months of 2014. Full compliance (100% phase-in) with the Tier 4 standards would have needed to be demonstrated beginning October 1, 2014.

Engine manufacturers reinforced the points we made in the proposal regarding added workload challenges for this diverse category of engines and machines. However, they suggested that the first of the proposed options to address these challenges (allowing use of Tier 2 credits) is not likely to be used due to a lack of available Tier 2 credits, and therefore should be dropped, and that the second option (allowing a slower phase-in) provided too short a stability period, and should be modified to delay final compliance by an additional 3 months, to December 31, 2014 or January 1, 2015. In addition to describing the very large redesign workload, they pointed out that engines and machines in this category typically do not have a model year that differs from the calendar year, and so the substantial changes required for Tier 4 compliance in October 2014 could force the need to change the product for all of 2014, effectively shortening the phase-in to two years. One manufacturer argued that the compliance date for the 75–100 hp engines in this category should be delayed an additional year, to 2016, and that the start of the phase-in for these engines should be likewise delayed from 2012 to 2013.

We do not feel that the first option (allowing use of Tier 2 credits) should be dropped, as it provides an alternative flexibility mechanism for a power category in which flexibility is clearly important, and is environmentally helpful as it provides an option for manufacturers to achieve NO_X emission reductions earlier than under the second option. By providing an opportunity to use Tier 2 credits in the 75–175 hp category, it coordinates well with the Tier 2 credit use opportunity we are providing for the 50–75 hp engines meeting the 2008 PM standard (see section III.A), and allows for coordinated redesign and credit use planning by a manufacturer over this wide power range over many years. Nonetheless, recognizing that the second option may be more attractive to manufacturers, and considering the comments they provided on it, we have concluded that a three month phase-in extension until the end of 2014 is warranted to address the workload burden and to align product cycle dates. Thus we are adopting the December 31, 2014 implementation date suggested in comments for completion of the 75–175 hp engine phase-in.

We do not agree that an additional year of delay is appropriate for the 75–100 hp engines in this category. The comment expressing interest in our doing so did not provide any basis for it in technological feasibility or in workload burden, and we do not see any basis for it ourselves.

Therefore, we are adopting both of the proposed optional measures for the 75–175 hp engine phase-in, except that in the second option, full compliance (100% phase-in) with the Tier 4 standards will need to be demonstrated beginning December 31, 2014. As proposed, manufacturers using this reduced phase-in option will not be allowed to generate NO_X credits from engines in this power category in 2012, 2013, and 2014, except for use in averaging within the 75–175 hp category (that is, no banking or trading, or averaging with engines in other power categories). We believe that this restriction on credit use is appropriate, considering that larger engine categories will be required to demonstrate a substantially greater degree of compliance with the 0.30 g/bhp-hr NO_X standard several years earlier than engines built under this option. As the purpose of this option is to aid manufacturers in implementing Tier 4 NO_X standards for this challenging power category, we do not want any manufacturers who might be capable of building substantially greater numbers of cleaner engines to use this option as an easy and copious source of credits (owing to its slower phase-in of stringent standards) that in turn can be used to delay building clean engines in other categories or model years.

c. Alternative Phase-In Standards

To ensure that Tier 4 engine development is able to take maximum advantage of highway diesel technology advances, we proposed to adopt nonroad diesel provisions in the averaging, banking, and trading program that would parallel the heavy-duty highway engine program's “split family provisions” (see 68 FR 28470, May 23, 2003). In essence, these allow a manufacturer to declare an engine family during the phase-in years that is certified at NO_X levels roughly midway between the phase-out standard and phase-in standard, without the complication of tracking credit generation and use. Because they constitute a calculational simplification of the emissions averaging provisions, these split family provisions do not result in a loss in environmental benefits compared to what the phase-in can achieve.

The nonroad proposal also included specific emission levels for these split families, rather than just describing how they are calculated. Commenters suggested that we go one step further still and express these levels as alternative standards. They argued that this would facilitate attempts at harmonizing standards globally, especially for standards-setting bodies such as the European Commission that do not have emissions averaging programs. We are also aware that most manufacturers of highway diesel engines are now planning to comply with our 2007 standards using this emissions averaging approach, increasing the significance of comments on the topic from nonroad engine manufacturers, many of whom also make highway engines.[30]

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[30] See the recently published “Highway Diesel Progress Review Report 2,” EPA420-R-04-004, available at http://www.epa.gov/otaq/diesel.htm#progreport2.

After carefully considering the issues involved, we agree that the proposed approach lends itself to expression in terms outside of the averaging, banking, and trading program and that it makes sense to do so. We are creating such an alternative in the final regulations accordingly. These alternative standards do not substantively change our Tier 4 program from what we proposed, but rather respond to manufacturers' suggestions for administrative simplifications to what is essentially an averaging-based flexibility option in demonstrating compliance with the percent-of-production NO_X phase-in. The alternative NO_X phase-in standards are shown in table II.A-3. They apply only during the NO_X phase-in years. Manufacturers may use both approaches within a power category if desired, certifying some engines to the alternative standards, with the rest subject to the phase-in percentage requirement. Note that engines under 75 hp subject to Tier 4 NO_X standards do not have an alternative standard because they do not have a NO_X phase-in, and engines over 750 hp do not have an alternative standard because of the separate standards we are adopting for these engines (explained in section II.A.4).

Table II.A-3. – Tier 4 Alternative NO_X Phase-in Standards (g/bhp-hr)

Engine Power	NO_X Standard (g/bhp-hr)
75 ≤ hp < 175 (56 ≤ kW < 130)	1.7 [a]
175 ≤ hp ≤ 750 (130 ≤ kW ≤ 560)	1.5

Notes: [a] Under the option identified in footnote b of table II.A-2, by which manufacturers may meet an alternative phase-in requirement of 25/25/25% in 2012, 2013, and 2014 through December 30, the corresponding alternative NO_X standard is 2.5 g/bhp-hr.

The engines certified under these standards will of course also need to meet the Tier 4 PM and crankcase control requirements that take effect for all engines in the first phase-in year. They will also need to comply with all Tier 4 provisions that would apply to phase-in engines, including the 0.14 g/bhp-hr NMHC standard and the NTE and transient test requirements for all pollutants. We recognize that this differs from what is required under the phase-in approach, in which these requirements would not apply to the 50% of engines categorized as “phase-out” engines. However, under the alternative standards approach, what would have been two different engine families (one meeting phase-in requirements and one meeting phase-out requirements, with NO_X and PM emissions averaging allowed between them under the ABT provisions) are replaced by a single engine family meeting the one set of alternative standards. Therefore all of the engines in this family must by default meet the phase-in requirements for provisions that lack any sort of averaging mechanism (NMHC standard, NTE, etc). As a result, any manufacturer choosing to design to the alternative standards rather than using the phase-in approach provides some additional environmental benefit as an indirect result of choosing this approach.

We also believe that this alternative standards provision makes appropriate a further adjustment to the NO_X phase-in scheme to better preserve both the advanced technology phase-in approach, for those manufacturers choosing that compliance path, and the alternative standards approach, for those choosing that path. Under the proposal, the provision for certifying a split engine family at a pre-designated NO_X level would not allow credit generation by or credit use on engines in the split family (other than for averaging within the family). This was consistent with our goal of providing a simple, single average NO_X standard level for the family, equivalent to arbitrarily designating a portion of the engines in the family as "phase-out" engines (credit generators) and the rest as "phase-in" engines (credit users) with a net credit balance of zero, while avoiding the burden of actually calculating and tracking credits. This was also consistent with our approach under the 2007 highway engine program from which this concept is derived.

However, because this split family provision has evolved into a set of alternative standards, there is no longer a need to prohibit the generation and use of ABT credits for these engines to preserve a de facto net zero credit balance, and so, considering that it is also not environmentally detrimental, we believe it is appropriate to allow credit use and generation for these engines as for other engines. A consequence of doing so, consistent with all of our ABT programs, is the adoption of NO_X FEL caps for these engines. To maintain the character of this compliance path as producing engines during the phase-in years that emit at NO_X levels which are roughly averaged between Tier 3 and final Tier 4 levels, we are setting NO_X FEL caps for these engines at levels reasonably close to the alternative standards. (See section III.A for details.) Because we are also maintaining the original phase-in/phase-out compliance path, a manufacturer wishing to build engines with NO_X levels higher than these FEL caps, at or approaching the Tier 3 levels, could still do so; in fact these would in actuality fit the description of a phase-out engine. This manufacturer would also, of course, have to produce a corresponding number of phase-in engines meeting the aftertreatment-based Tier 4 NO_X standards.

We also observe that the creation of alternative standards provides the opportunity to adjust the phase-in/phase-out provisions so as to reinforce their focus on introducing high-efficiency NO_X aftertreatment technology during the phase-in years, which is, of course, their aim. We are doing this by setting NO_X family emission limit (FEL) caps for phase-in engines at the same low levels as for Tier 4 engines produced in the post-phase-in years. (Again, see section III.A for details.) Although the engine manufacturers indicated in their comments that they did not believe it likely that anyone would choose this phase-in/phase-out compliance path, we believe that preserving it and focusing it on encouraging very low-NO_X engines as early as possible provides a potentially useful and environmentally desirable alternative path. Thus these two concepts have been developed to provide complementary compliance paths obtaining equivalent overall NO_X reductions, one focused on phasing in high-efficiency NO_X aftertreatment and the other on achieving NO_X control for all subject engines during the phase-in years at an average level between the Tier 3 and final Tier 4 standards levels.

3. Standards for Smaller Engines

a. Engines under 25 hp

We are finalizing the Tier 4 program we proposed for engines under 25 hp. In the proposal we presented our view that standards based on the use of PM filters should not be set at this time for the very small diesel engines below 25 hp. We also discussed our plan to reassess the appropriate long-term standards in a technology review. However, for the nearer-term, we concluded that other proven PM-reducing technologies such as diesel oxidation catalysts and engine optimization could be applied to engines under 25 hp. Accordingly, we proposed Tier 4 PM standards to take effect beginning in 2008 for these engines based on use of these technologies.

In contrast to our proposals for other engine categories, the proposed Tier 4 standards for this category elicited very little comment from the engine manufacturers other than an expression of support for deferring consideration of any more stringent standards pending results of a future technology review. The States and environmental organizations expressed disappointment that EPA had not proposed more stringent standards for these engines, given the very large number of these engines in the field and the significant risk they pose due to individuals' exposure to diesel PM and air toxics. They urged more stringent 2008 PM standards and the adoption of standards obtaining emission reductions of 90% or more by the end of 2012. Emissions control manufacturers argued that more stringent 2008 standards based on the use of more efficient oxidation catalysts are feasible.

As discussed in section II.B.4, we continue to believe that the standards we proposed for engines under 25 hp are feasible, and commenters in the nonroad diesel industry provided no comments to the contrary. Our reasons for not proposing more stringent Tier 4 standards for these engines based on the use of PM filters and NO_X aftertreatment were mainly focused on the cost of equipping these relatively low cost engines with such devices, especially considering the prerequisite need for electronic fuel control systems to facilitate regeneration. The comments supporting more stringent standards were not convincing, as they did not address these cost issues. However, we do agree that these small engines likely have a large impact on human health, and, as discussed in section VIII.A, we are reaffirming the plan we described in the proposal to reassess the appropriate long-term standards for these engines in a technology review to take place in 2007. We will set more stringent standards for these engines at that time, if appropriate.

We also disagree with comments supporting more stringent 2008 standards that would require the use of diesel oxidation catalysts on all small engines. Although we agree that these catalysts can be applied so as to achieve emission reductions on some small engines, the emissions performance data we have analyzed do not support our setting a more stringent standard. Section 4.1.5 of the RIA summarizes such data showing a very wide range of engine-out PM emissions in this power category. Applying oxidation catalyst technology to these

engines, though capable of some PM reduction if properly designed and matched to the application, is limited by sulfur in the diesel fuel. Specifically, precious-metal oxidation catalysts (which have the greatest potential for reducing PM) can oxidize the sulfur in the fuel and form particulate sulfates. Even with the 500 ppm maximum sulfur fuel available after 2007, the sulfate production potential is large enough to limit what can be done to set more stringent 2008 PM standards through the use of these catalysts. The 15 ppm maximum sulfur fuel available after 2010 will greatly improve the potential for use of oxidation catalysts, but as we discussed above, we believe that the much larger potential reduction afforded by PM filter technology warrants our waiting until the technology review in 2007 to evaluate the appropriate long-term standards for these engines. See section II.B.5 and RIA section 4.1.5 for further discussion.

When implemented, the Tier 4 PM standard and related provisions we are adopting today for engines under 25 hp will yield an in-use PM reduction of over 50% for these engines, and large reductions in toxic hydrocarbons as well. Achieving these emission reductions is very important, considering the fact that many of these smaller engines operate in populated areas and in equipment without closed cabs-- in mowers, portable electric power generators, small skid steer loaders, and the like.

We are also adopting the alternative compliance option that we proposed for air-cooled, direct injection engines under 11 hp that are startable by hand, such as with a crank or recoil starter. As we explained in the proposal, the alternative is justified due (among other things) to these engines' need for loose design fit tolerances, their small cylinder displacement and bore sizes, and the difficulty in obtaining components for them with tight enough tolerances (68 FR 28363, May 23, 2003). This alternative allows manufacturers of these engines to delay Tier 4 compliance until 2010, and in that year to certify them to a PM standard of 0.45 g/bhp-hr, rather than to the 0.30 g/bhp-hr PM standard applicable beginning in 2008 to the other engines in this power category. As proposed, engines certified under this alternative compliance requirement will not be allowed to generate credits as part of the ABT program, although credit use by these engines will still be allowed.

We received no adverse comments on this proposed alternative for qualifying engines under 11 hp. Euromot commented that there are hand-startable engines in the 11–25 hp range, and that we should extend the alternative compliance option to these engines as well. However, hand-startability is not the sole defining feature of engines for which we established this alternative. Rather, the alternative is for a class of engines typified by a combination of characteristics (very small, air-cooled, direct injection, hand-startable), which give rise to the potential technical difficulties noted above. To extend the alternative to other engines simply because they have a hand-start is not justified, because they do not share these technical difficulties (or do not share them to the same degree). Such an extension could also potentially encourage manufacturers of the many models of these larger engines to market a hand-start option simply to avoid more stringent standards.

b. Standards for 25–75 hp Engines

We proposed a 0.22 g/bhp-hr PM standard for 25–75 hp engines, to take effect in 2008. We also proposed a filter-based 0.02 g/bhp-hr PM standard for these engines, to take effect in 2013, the year in which filter-based technology for these engines is expected to be applicable on a widespread basis (see section II.A.1). Also in 2013, the 25–50 hp engines would be subject to the 3.5 g/bhp-hr NMHC+NO_X standard already adopted for 50–75 hp engines (taking effect in 2008 as part of Tier 3). We are adopting all of these proposed standards in this final rule.

The 2008 PM standard for these engines should maximize reduction of PM emissions using technology available in that year. We believe that the 2008 PM standard is feasible for these engines, based on the same engine or oxidation catalyst technologies feasible for engines under 25 hp in 2008, following the introduction of nonroad diesel fuel with sulfur levels reduced below 500 ppm. We expect in-use PM reductions for these engines of over 50% (and large reductions in toxic hydrocarbons as well) over the five model years this standard would be in effect (2008–2012). These engines will constitute a large portion of the in-use population of nonroad diesel engines for many years after 2008. Although we are finalizing the 2013 standards for 25–75 hp engines today, we are also reaffirming our commitment to conducting a technology review for these standards in 2007. This planned review is discussed in section VIII.A. Additional discussion of our feasibility assessment for the 2008 and 2013 standards can be found in section II.B.4 and RIA section 4.1.4.

In comments, emissions controls manufacturers argued that more stringent 2008 standards for PM and NMHC based on the use of more efficient oxidation catalysts are feasible and should be adopted. Environmental organizations argued that PM and NO_X standards for 2008 should be set at more stringent levels, based on the use of oxidation catalysts and improved engine optimization. The California Air Resources Board argued for more stringent 2008 standards for HC+NO_X, PM and toxics, based on the use of oxidation catalysts.

We disagree with the comments calling for more stringent 2008 standards than proposed for 25–75 hp engines, based on the use of diesel oxidation catalysts. The standards we proposed and are adopting for these engines pull ahead sizeable PM reductions starting three years ahead of the earliest PM filter-based standards for any engine size. The pull-ahead standard level balances early reductions with the need to ensure that the PM filter-based standards and Tier 3 NMHC+NO_X standards are not jeopardized by an overemphasis on early reductions. Although we agree that oxidation catalysts can be applied to these engines, the emissions performance data we have analyzed do not support our setting a more stringent standard, for the same reasons described above in section II.A.3.a for engines under 25 hp. Refer to section II.B.4 and to section 4.1.4 of the RIA for additional discussion. For a discussion of comments opposed to new standards in 2008, see sections II.A.1 and II.B of this preamble.

We also do not agree that more stringent NO_X requirements based on improved engine optimization are appropriate for these engines in 2008. In 2001 we reviewed and confirmed the

previously set NMHC+NO_X emission standards that will be in effect for these engines during the time frame in question.[31] Because of the focus we are putting on achieving large PM reductions from these engines as early as possible, we felt that it was important to strike a balance between PM and NO_X control. As a result, we did not propose more stringent NO_X standards for 50–75 hp engines, and we proposed to apply the 3.5 g/bhp-hr NMHC+NO_X standard to 25-50 hp engines in 2013 because this is the year in which the PM filter-based standard is being implemented. Requiring new NO_X controls for these engines earlier than 2013 would add a third redesign step to those already called for in 2008 and 2013. This would add a potentially unacceptable amount of redesign workload, to a point that it could jeopardize our objective of bringing stringent PM control to these engines as early as possible.

Consistent with the proposal, we are not setting more stringent NO_X standards for engines below 75 hp at this time based on the use of NO_X aftertreatment. As discussed in section 4.1.2.3 of the RIA, a high degree of complexity and engine/aftertreatment integration will be involved in applying NO_X adsorber technology to nonroad diesel engines. The similarity of larger nonroad engines (above 75 hp) to highway diesel engines, which will provide the initial experience base for this integration process, is key to our assessment that NO_X adsorbers are feasible for these engines. On the other hand, although engines under 75 hp are gradually increasing in sophistication over time, the accumulation of experience with designing and operating these engines with more advanced technology clearly lags significantly behind the sizeable experience base already developed for larger engines. At this point, we are unable to forecast how quickly adequate experience may accrue. Because this experience is crucial to ensuring the successful integration of the engines with NO_X adsorber technology, we are not adopting NO_X adsorber-based standards for engines under 75 hp in this final rule. Rather, as discussed in section VIII.A, we plan to undertake a technology assessment in the 2007 time frame which would evaluate the status of engine and emission control technologies, including NO_X controls, for engines less than 75 hp.

As described in section II.A.1.a, we are providing two PM standard compliance options to engine manufacturers for 50-75 hp engines. As part of this, we also proposed a measure to ensure that it would not be abused by equipment manufacturers who use engines that do not meet the PM pull-ahead standard in 2008-2011, but who then switch engine suppliers to avoid PM filter-equipped engines in 2012 as well (68 FR 28360, May 23, 2003). We proposed that an equipment manufacturer making a product with engines not meeting the pull-ahead standard in any of the years 2008–2011 must use engines in that product in 2012 meeting the 0.02 g/bhp-hr PM standard; that is, the equipment manufacturer would have to use an engine from the same engine manufacturer or from another engine manufacturer choosing the same compliance option. We also solicited comment on possible alternative solutions using a numerical basis, describing an example that would require the percentage of 50–75 hp machines equipped with PM filters in

[31] "Nonroad Diesel Emissions Standards Staff Technical Paper," EPA420-R-01-052, October 2001.

2012 to be no less than the same percentage of 50–75 hp machines produced with non-pull-ahead engines in 2008–2011.

The Engine Manufacturers Association (EMA) and Deere commented on the unenforceability of the proposed "no switch" measure as part of a broader objection to our proposal for 50–75 hp engines. They pointed out that changing equipment model designations could easily allow an equipment manufacturer seeking to avoid PM filter-equipped engines in 2012 to declare a product in this model year a "new product," not the same as the 2008–2011 product. We have concluded that there is indeed potential for this abuse to occur and, although no one commented specifically on the alternative approach, we believe it clearly addresses this problem because it does not depend on product designations.

Therefore, we are adopting a provision to discourage engine switching based on this alternative approach. An equipment manufacturer who uses 50–75 hp engines will have three options:

1) The manufacturer may exclusively use engines certified to the 0.22 g/bhp-hr PM standard (including through use of ABT credits) over the 2008-2011 period. This manufacturer is then free to use any number of 50–75 hp engines not certified to the 0.02 g/bhp-hr standards in 2012.
2) The manufacturer may exclusively use engines not certified to the 0.22 g/bhp-hr PM standard over the 2008–2011 period. This manufacturer must then use only 50–75 hp engines that are certified to the 0.02 g/bhp-hr standards in 2012 (including through use of ABT credits).
3) The manufacturer may use a mix of engines in 2008–2011. In this case, the manufacturer must calculate the percentage of 50–75 hp engines used (in U.S.-directed equipment) over the 2008–2010 period that are not certified to the 0.22 g/bhp-hr PM pull-ahead standard. Then the percentage of 50–75 hp engines this manufacturer uses in 2012 that are certified to the 0.02 g/bhp-hr PM standard must be no less than this 2008–2010 non-pull-ahead percentage figure minus a 5% margin.[32]

As an example of this third option, consider an equipment manufacturer who does not use the transition flexibility provisions (described in section III.B), and over the 2008–2010 period makes 1000 50–75 hp machines for use in the U.S., 200 (20%) of which use engines not certified to the 0.22 g/bhp-hr standard. In 2012, that manufacturer must make at least 15% of his 50–75 hp machines for use in the U.S. using engines certified to the 0.02 g/bhp-hr standard. We feel that the 5% margin is needed to allow for some reasonable sales shifts within the manufacturer's

[32] The 2011 production is not included in the percentage calculation to avoid the need for post-2011 confirmation of production volumes which, as it would occur in 2012, would be too late to easily re-focus 2012 production if the confirmed volumes differ from projections. It is not likely that manufacturers would abuse the program by switching engine suppliers for this one year of production.

product offering over time, but is small enough to ensure that any possible advantage gained from selling higher-emissions products remains minimal. Equipment manufacturers must keep production records sufficient to prove compliance. This restriction and the percentage calculation will not apply to any 2008–2012 engines at issue that are being produced under the equipment manufacturer transition flexibility provisions discussed in section III.B. For example, if in addition to the 200 engines in 2008-2010 not certified to the 0.22 g/bhp-hr standard in the above example, this manufacturer also used 500 previous-tier engines in 2008–2010 under the flexibility allowance program, his percentage target for PM filter-equipped engines in 2012 would be 35% of all the engines used in 2012 that are not previous-tier engines under the flexibility allowance program.[33]

4. Standards for Engines Above 750 hp

We are adopting different Tier 4 standards for over 750 hp engines from those we proposed, and we are also adopting different implementation dates for these engine standards, though both the proposed and final programs have as their primary focus the implementation of high-efficiency exhaust emission controls as quickly as possible. The approach being adopted reflects our careful review of the technical issues presented by these engines. For some of these engines, we are accelerating standards based on the use of aftertreatment controls. For others, we are deferring a decision on such aftertreatment-based standards. This approach represents a feasible and efficient approach to redesigning engines and installing aftertreatment in a coordinated, orderly manner over a decade or more, and will achieve major reductions in PM and NO_X from these large diesel engines.

Under the proposal, all engines above 750 hp were treated the same, with a phase-in of PM and NO_X aftertreatment technology that started in 2011 and finished in 2014. The final standards are based on our evaluation of the differing technical issues presented by the two primary kinds of equipment in this category, mobile power generation equipment (generator sets) and mobile machinery. For both generator sets and mobile machinery, PM aftertreatment-based standards will start in 2015, with no prior phase-in. EPA is replacing the proposed phase-in with a PM standard starting in 2011 that is comparable to the overall level of control that the proposed phase-in would achieve. Differences within these applications, however, call for different approaches to the implementation of NO_X aftertreatment technology. For generator sets above 1200 hp, an aftertreatment-based NO_X standard will start in 2011, three years earlier than the date we proposed for full implementation of such standards. For generator sets below 1200 hp, the same aftertreatment-based NO_X standard will start in 2015. As with the PM standard, there is no phase-in. For engines used in mobile machinery, which is assumed to include all equipment that is not a generator set, EPA is deferring a decision on setting aftertreatment-based NO_X standards to allow additional time to evaluate the technical issues involved in adapting NO_X adsorber technology to these applications and engines. However, EPA is adopting a NO_X standard for these engines starting in 2011 that will achieve large NO_X reductions by relying on engine-based

[33] That is: [200/(1000-500)] = 40%; subtracting the 5% margin then yields 35%.

emissions control technology. Consistent with the different approaches we are taking to setting standards for engines above and below 750 hp, we are also adopting restrictions on ABT credit use between these power categories, as described in section III.A.

Consistent with the approach we took in previous standard-setting for these engines, we proposed that nonroad diesels above 750 hp be given more lead time than engines in other power categories to fully implement Tier 4 standards, due primarily to the relatively long product design cycles typical of these high-cost, low-sales volume engines and machines. Specifically, we proposed that this category of engines move directly from Tier 2 to Tier 4, and that the Tier 4 PM standard be phased in for these engines on the same 50-50-50-100% schedule as the NO_X and NMHC phase-in schedule, over the 2011–2014 model years. This would provide engine manufacturers with up to 8 years of design stability to address concerns specific to this category. Although we expressed our belief that these proposed provisions would enable the manufacturers to meet proposed Tier 4 engine standards, we also acknowledged concerns the manufacturers had expressed to us, and asked for comment on whether this category, or some subset of it defined by hp or application, should have a later phase-in start date, a later phase-in end date, adjusted standards, additional equipment manufacturer transition flexibility provisions, or some combination of these (68 FR 28364, May 23, 2003).

Comments from manufacturers of engines and equipment in this power category expressed their widespread view that the proposed standards were inappropriate in critical respects. In addition to reiterating the need for extra lead time due to long product design cycles, they pointed to difficulties with aftertreatment placement, with fabrication of the large filters that would be needed for these engines, with potential failures caused by uneven soot loading and regeneration in large filters, with stresses due to thermal gradients across large filters, and with mechanical stresses in mining applications with high shock loads. The manufacturers noted that aftertreatment-based standards for NO_X and PM were feasible for engines used in large mobile power generators. However, manufacturers did not believe aftertreatment-based NO_X standards could be implemented in the time frame proposed for engines used in large mobile machinery such as bulldozers and mine haul trucks. States, environmental organizations, and manufacturers of emissions controls, on the other hand, expressed support for the standards we proposed for these engines.

After evaluating these issues, EPA is adopting an approach that tailors the standards to the circumstances presented by the different kinds of engines in this power category. The NO_X standards we are adopting will achieve effective NO_X control by accelerating the proposed schedule for final NO_X standards based on high-efficiency NO_X aftertreatment for the largest generator sets, and by requiring engines in other generator sets to also meet aftertreatment-based NO_X standards, although we are delaying the implementation date for these standards compared to the implementation schedule we proposed. We believe that NO_X adsorber technology will be feasible for these generator set engines. We also believe that they may be an especially attractive application for Selective Catalytic Reduction (SCR) technology, which relies on the injection of urea into the exhaust stream. There are many stationary diesel generator sets using SCR today.

Large mobile generator sets, though moved from location to location, operate much like stationary units once in place, with fuel (and potentially urea) delivered and replenished periodically. See section II.B.3 for further discussion.

For equipment other than generator sets, we are deferring a decision on setting aftertreatment-based NO_X standards to allow additional time to evaluate the technical issues involved in adapting NO_X control technology to these applications and engines. We are still evaluating the issues involved for these engines to achieve a more stringent NO_X standard, and believe that these issues are resolvable. We intend to continue evaluating the appropriate long-term NO_X standard for mobile machinery over 750 hp and expect to announce further plans regarding these issues (we are currently considering such an action in the 2007 time frame). The basis for the 0.50 g/bhp-hr NO_X standard we are adopting for generator sets over 750 hp is discussed in section II.B.3. We are also modifying the PM and NMHC standards we proposed (as well as certain implementation dates for these provisions), and modifying our proposed approach to ensuring transient emissions control for these engines (discussed in section III.F). The Tier 4 standards for engines over 750 hp are shown in table II.A-4.

Table II.A-4. – Tier 4 Standards for Engines Over 750 hp (g/bhp-hr)

engines used in:	2011			2015		
	PM	NO_X	NMHC	PM	NO_X	NMHC
generator sets ≤1200 hp	0.075	2.6	0.30	0.02	0.50	0.14
generator sets >1200 hp	0.075	0.50	0.30	0.02	no new standard	0.14
all other equipment	0.075	2.6	0.30	0.03	no new standard	0.14

Unlike NO_X control technology, we believe that the more advanced state of PM filter technology development today makes their availability for these engines by 2015, with over ten years of development lead time, more certain, and so we are setting PM standards for both mobile machinery and generator sets based on use of this technology. We note in section II.B.3 that achieving durable PM filter designs for these large applications will likely require the use of wire mesh filter technology rather than the somewhat more efficient wall flow ceramic-based technology applicable to smaller engines, justifying the somewhat higher level for the 2015 PM standards shown in table II.A-4 (0.03 or 0.02 g/bhp-hr compared to 0.01 g/bhp-hr). Section II.B.3 also contains discussion of our bases for the other Tier 4 standard levels in this category. We believe that the 2015 implementation year (versus the proposed 2014 date for the fully phased-in standard) is necessary to allow development of the requisite technologies for these large engines, and to deal with the redesign workload Tier 4 will create for the many engine and equipment models in this category which, as noted, typically have very low production volumes and long product cycles.

For the purpose of determining which nonroad engines are subject to the generator set standards, we are defining a generator set engine as: "An engine used primarily to operate an electrical generator or alternator to produce electric power for other applications." This definition makes it clear that generator set engines do not include engines used in machines such as mine trucks that do mechanical work but that employ engine-powered electric motors to propel the machine, but they do include engines in nonroad equipment for which the primary purpose is to generate electric power, even if the machine is also self-propelled.

Similar to other power categories, we proposed a 50% phase-in to the final Tier 4 PM, NO_X and NMHC standards, with opportunity to average PM and NO_X between phase-in and phase-out engines in the 2011-2013 phase-in years via the ABT program. Because in this rule we are no longer phasing in to a final NO_X standard for some engines over 750 hp, it no longer makes sense to express the 2011 standards for these engines in this manner. Instead we are setting brake-specific emission standards effective in 2011. Furthermore, to avoid further complicating an already complex standards structure, we are adopting this pattern for the entire category, even with engines such as those used in generator sets for which the standards could still be expressed as a percent phase-in to final standards. Except for the pull-ahead of the long-term NO_X standard for large generator sets (which will increase the environmental benefit compared to the proposal), these 2011 PM and NO_X standards essentially correspond to averaged standards under a 50% phase-in to aftertreatment-based standards, hence our conclusion that the Tier 4 program will provide a level of control in 2011 that is substantially equivalent to that of the proposal. In addition, PM and NO_X emissions averaging through the ABT program will allow a manufacturer to comply by phasing in aftertreatment technologies as in the proposed program, should they desire to do so. Although there is no such averaging program for NMHC, the 2011 NMHC standard can be achieved without the use of advanced aftertreatment (as explained in section II.B.3), thus helping to enable a manufacturer to pursue this compliance strategy if desired.

This approach involving separate 2011 and 2015 standards is comparable to the proposed percent phase-in approach with emissions averaging. We believe that it enables manufacturers to redesign engines and equipment in a coordinated, orderly manner over a decade or more, and effectively gives targeted additional flexibility to the industry. Given the continuing availability of emissions averaging, we do not view this change as the creation of an additional, separate tier of standards compared to the proposal's phase-in of the Tier 4 standards.

5. Establishment of New Power Categories

We are finalizing our proposal to regroup the nine power categories established for previous tiers into the five Tier 4 power categories shown in table II.A-1. As we explained in the proposal, this regrouping will more closely match the degree of challenge involved in transferring advanced emissions control technology from highway engines to nonroad engines. The proposed choice of 75 hp as the appropriate cutpoint for applying aftertreatment-based NO_X control drew particular attention. In the proposal, we recognized that there is not an abrupt

power cutpoint above and below which the highway-derived nonroad engine families do and do not exist, but noted further that 75 hp is a more appropriate cutpoint to generally identify nonroad engines in Tier 4 that will most likely be using highway-like engine technology than either of the closest previously-adopted power category cutpoints of 50 or 100 hp. Nonroad diesels produced today with rated power above 75 hp (up to several hundred hp) are mostly variants of nonroad engine platforms with four or more cylinders and per-cylinder displacements of one liter or more. These in turn are largely derived from or are similar to heavy-duty highway engine platforms. Even where nonroad engine models above 75 hp are not so directly derived from highway models, they typically share many common characteristics such as displacements of one liter per cylinder or more, direct injection fueling, turbocharging, and, increasingly, electronic fuel injection. These common features provide key building blocks in transferring high-efficiency exhaust emission control technology from highway to similar nonroad diesel engines. We therefore proposed to regroup power ratings using the 75 hp cutpoint.

The Engine Manufacturers Association and Euromot, which together represent the companies that make all but a tiny fraction of nonroad diesel engines sold in the U.S., expressed their support for the 75 hp cutpoint, as did every individual engine manufacturer who commented on this subject. These companies generally endorsed EPA's reasoning that the 75 hp level is appropriate to "delineate those engines (and applications) for which the application of on-highway like NO_X aftertreatment technologies is not likely to be feasible or practical" (EMA Comments p.10).

However, the Association of Equipment Manufacturers (AEM) and the equipment manufacturer Ingersoll-Rand commented that 100 hp is the more appropriate cutpoint for application of advanced NO_X control technology. They based this view on their observations that 75-100 hp engines do not share many of the characteristics of highway diesels, thus making technology transfer from the highway sector very costly, and customers will be negatively affected due to the relatively large cost impacts of NO_X aftertreatment on these smaller engines. They also argued that the 75 hp cutpoint would create significant misalignment in the global marketplace because European regulations do not use this cutpoint.

We agree with the equipment manufacturers' observation that there are engines above 75 hp without turbocharging or electronic controls. However, EPA did not choose the 75 hp cutpoint with the expectation that all engines above it had the same technology characteristics. There is a continuum in the degree to which key technology characteristics exist on engines throughout the power spectrum, and the 75 hp cutpoint was based on information from the current fleet of engines and on manufacturers' and EPA's expectations for future design trends, showing there is a marked difference in the prevalence of these and other key engine design characteristics for engines above and below 75 hp, and that, over time, 75–100 hp engines increasingly share advanced technology characteristics common in larger engines. Clear evidence of this trend over recent model years is documented in the RIA, section 4.1.4. As discussed in section II.B.2, the kind of engine technology generally employed by engines in the 75–100 hp range, combined with the lead time and phase-in provided for the Tier 4 NO_X

standards, leads us to conclude that highway-like NO_X aftertreatment can be transferred to these engines. In addition, since our proposal, the Council of the European Union (EU) has issued a revised final version of new nonroad diesel emission standards that essentially aligns their power cutpoints with our own, including adoption of the 75 hp cutpoint for advanced technology NO_X control. EPA does not believe that the costs of meeting the NO_X standard for engines in the 75-100 hp range are unreasonable, and we refer the reader to section VI for a detailed discussion of our cost analysis for engines and equipment meeting Tier 4 standards in this power range. Moreover, EPA firmly believes such standards are technologically feasible for 75–100 hp engines. (See section II.B.2.)

Ingersoll-Rand also expressed concern that the proposed consolidation of 3 previous power categories into a single 175–750 hp category creates significant hardship by requiring the introduction of aftertreatment technologies in a single year, contrasting this with the Tier 2 standards, which phased in over 2001–2003 for these engines. In response, we note that the Tier 3 standards, which were set in the same rule that established the Tier 2 standards, will be introduced in a single year for these engines (2006), and that the Tier 2 phase-in over 3 years was established in response to particular issues and opportunities that were identified, specific to that time frame (see 62 FR 50181, September 24, 1997). In addition to the gradual phase-in of Tier 4 standards over several years, we are adopting significant flexibility provisions specifically to provide adequate lead time for equipment manufacturers to make the transition to the new standards, including some provisions that provide additional flexibility from what we proposed, as explained in section III.B.

6. CO Standards

We proposed minor changes in CO standards for some engines solely for the purpose of helping to consolidate power categories. We stated in the proposal that we were not exercising our authority to revise the CO standard for the purpose of improving air quality, but rather for purposes of administrative efficiency. However, manufacturers objected to these proposed changes, citing technological feasibility concerns, and a lack of parity with highway diesel and nonroad spark-ignition engines, given that existing CO standards levels for nonroad engines are already five times lower than the standard level for highway engines.

Because we proposed the CO standard changes for the sake of simplifying and consolidating power categories and not because of any technical considerations relating to emission reductions, we do not believe it productive to take issue with the views expressed that these proposed changes raise serious feasibility concerns. We instead are withdrawing this aspect of the proposal, the result being that the existing CO standards remain in place. In doing so, we are not considering or reexamining (and at proposal did not consider or reexamine) the substantive basis for those standards. Having multiple CO standards within a power category will, at worst, create minor inconveniences in certification and compliance efforts. As a result, in the less than 25 hp category, Tier 4 engines below 11 hp will continue to be subject to a different

CO standard than 11–25 hp engines, identical to Tier 2. Likewise, different CO standards will continue to apply in Tier 4 to engines above and below 50 hp in the 25–75 hp category.

We do note, however, that we are applying new certification tests to all pollutants covered by the rule, the result being that Tier 4 engines will have to certify to CO standards measured by the transient test (NRTC) (which includes a cold start test), and the NTE. Our intent in adopting these new certification requirements is not to alter the level of stringency of the standard but rather to ensure robust control of emissions to this standard in use. The CO standards remain readily achievable using these tests, and we anticipate that no additional engine adjustments are necessary for the standards to be achievable (so there are no significant associated costs). We also explain there that the CO standards can be achieved without jeopardizing the ability to achieve all of the other engine standards.

7. Crankcase Emissions Control

We currently require the control of crankcase emissions from naturally-aspiriated nonroad diesel engines. We proposed to extend this requirement to turbocharged nonroad diesel engines as well, starting in the same model year that Tier 4 exhaust emission standards first apply in each power category.

EMA opposed the proposed extension, reiterating concerns expressed in comments on a similar proposed provision in the 2007 heavy-duty highway rule, including concerns over the impact that recirculating crankcase emissions may have on the feasibility of engine standards over the full useful life. These concerns are addressed in the Summary and Analysis of Comments document for that rule, which is included in the docket for today's rule. Besides the feasibility issues raised by EMA for nonroad diesels that are addressed in the highway rule, two nonroad-specific issues were raised as well: (1) the need to design crankcase emission control systems that operate at the high angularity experienced by some nonroad machines on uneven ground, and (2) the concern that this requirement adds to the large number of “first time” requirements being adopted for Tier 4. We agree that high angularity operation may add new design considerations for these controls, but do not see how it would pose a serious barrier that could not be overcome in time. The grouping of new EPA requirements in a specific model year is an important objective of our program aimed at providing stability to the design process, a goal much supported by the engine manufacturers. We have accounted for this in assessing feasibility, costs, and flexibility needs for the program. One flexibility we are providing is the three-path opportunity to satisfy our crankcase control requirement, as described below. In fact, in its written comments EMA recommended that, if EPA were to proceed with crankcase emission control requirements for Tier 4, it adopt all three options for demonstrating compliance. This is indeed what we are doing.

Thus, as proposed, in addition to allowing for compliance through the routing of crankcase emissions to the engine air intake system, we are also allowing manufacturers to instead meet the requirement by routing the crankcase gases into the exhaust stream, provided

they keep the combined total of the crankcase emissions and the exhaust emissions below the applicable exhaust emission standards. Also as proposed, we are allowing manufacturers to instead meet the requirement by measuring crankcase emissions instead of completely eliminating them, provided manufacturers add these measured emissions to exhaust emissions in assessing compliance with exhaust emissions standards. Manufacturers using this option must also modify their exhaust deterioration factors or develop separate deterioration factors to account for increases in crankcase emissions as the engine ages, and must ensure that crankcase emissions can be readily measured in use. We see no reason to treat naturally-aspirated engines differently than turbocharged engines, and so are allowing these options for all Tier 4 engines subject to the crankcase control requirement, both turbocharged and naturally-aspirated. The wording of the proposed regulations limiting the options to turbocharged engines was inadvertent.

8. Prospects for International Harmonization

We received numerous comments, especially from engine and equipment manufacturers, stressing the need for EPA to work with other governmental standards-setting bodies to harmonize standards. We recognize the importance of harmonization of international standards and have worked diligently with our colleagues in Europe and Japan to achieve that objective. Harmonization of these standards will allow manufacturers continued access to world markets and lower the required research and development and tooling costs needed to meet different standards. We will continue to work with standards-setting governmental entities and with foreign and domestic manufacturers.

In October 2003, the Council and Parliament of the European Union reached agreement on revisions to a proposal developed by the European Commission that would amend Directive 97/68/EC to include nonroad diesel emissions standards similar to those in our Tier 4 program, and, as in the U.S., coordinated with low sulfur diesel fuel requirements in the Europe. This revised proposal has since been finalized.[34] This revised Directive aligns well with our program in the Tier 4 time frame, even more so than did the original Commission proposal. It also closely aligns with our Tier 3 standards in the Tier 3 time frame.

For engines of 50–750 hp, the Directive's standards are very closely aligned with our own Tier 4 standards, including emissions levels, implementation dates, the defined power categories, and the lower hp limit of NO_X control based on high-efficiency exhaust emission controls (75 hp). Exceptions are noted below:

- The 2008 PM standard level for 50–75 hp engines (the equivalent of 0.3 g/bhp-hr vs our 0.22 g/bhp-hr level). Note, however, that we do allow certification to the 0.3 g/bhp-hr level as an option, provided the manufacturer must then meet our 0.02 g/bhp-hr standard in 2012, one year earlier than otherwise.

[34] Council of the European Union, "Directive of the European Parliament and of the Council amending Directive 97/68/EC", March 15, 2004.

- The 2013 PM standard level for 50–75 hp engines (the equivalent of 0.01 g/bhp-hr vs our 0.02 g/bhp-hr level).
- An October 1, 2014 start for the final 75–175 hp NO_X standard (the same as our proposed date), compared to the December 31, 2014 date we are adopting in this final rule.
- For constant speed engines: no Tier 4-equivalent standards. Also, the EU's Tier 3-equivalent standards are not implemented on these engines until 2011–2012.

As the EU program does not provide for emissions averaging, the alternative NO_X standards we are setting for 75–750 hp engines are the NO_X levels at which the EU standards are generally aligned during our NO_X phase-in years. The EU Directive also includes transition flexibility provisions for equipment manufacturers similar to those in our program, discussed in section III.B.

The EU program for nonroad diesels has not adopted or proposed any current or future standards for engines above 750 hp or below 25 hp, and its revised Directive for 25–50 hp engines does not subject them to any future standards beyond those entering into force in 2007 (equivalent to 0.45 g/bhp-hr PM and 5.6 g/bhp-hr hydrocarbon+NO_X), in contrast to our 2013 standards based the use of PM filters and more advanced engine-based control technologies (0.02 g/bhp-hr PM and 3.5 g/bhp-hr NMHC+NO_X). However, as discussed further in section VIII.A, the EU Directive includes plans to conduct a future technology review of appropriate standards for engines below 50 hp and above 750 hp. The year that this is planned for is 2007, the same year in which we are planning a technology review for engines below 75 hp. Considering progress to date, and announced plans for reviews in 2007, we believe that prospects for harmonized standards are excellent.

9. Exclusion of Marine Engines

For reasons outlined in the proposal, we are not applying Tier 4 standards to the marine diesel engines under 50 hp that are covered under our Tier 1 and 2 standards. We believe it is more appropriate to consider more stringent standards for a range of marine diesel engines, including these, in a future action. It should be noted that the existing Tier 2 standards will continue to apply to marine diesel engines under 50 hp until that future action is completed. We did not receive any adverse comments on this proposed approach.

B. Are the New Standards Feasible?

Today we are finalizing a program of stringent new standards for a broad category of nonroad diesel engines coupled with a new nonroad diesel fuel standard that dramatically lowers the sulfur level in nonroad diesel fuel ultimately to 15 ppm. We believe these standards are technically feasible in the leadtime provided given the availability of 15 ppm sulfur fuel and the rapid progress to develop the needed emission control technologies. We acknowledge, as pointed out by a number of commenters, that these standards will be challenging for industry to meet, in part due to differences in operating conditions and duty cycles for nonroad equipment

and the diesel engines used in that equipment. Also, we recognize that transferring and effectively applying these technologies, which have largely been developed for highway engines, will require additional time after the application of the technology to on-highway engines. Diesel engine industry commenters and environmental stakeholder commenters on our proposal consistently agreed with our position that for most engine horsepower categories the technologies to meet the standards exist and that the transfer of these technologies to nonroad is possible. The biggest difference of opinions in the range of comments received by the Agency concerns the timing of the emission standards and the flexibility provisions (i.e., the leadtime necessary to transfer the technology). One of the most important tasks for a feasibility analysis is to determine the appropriate amount of development time needed to successfully bring new technologies to market. We have carefully weighed the desire to have clean engines sooner, with the challenges yet to be overcome in applying the technologies to nonroad engines and equipment, in determining the appropriate timing and emission levels for the standards finalized today.

The RIA associated with today's action contains a detailed description and analysis of diesel emission control technologies, issues specific to applying these technologies to nonroad engines, and why we believe the new emission standards are feasible. Additional in-depth discussion of these technologies can be found in the final RIA for the HD2007 emission standards, the final RIA for the HD2004 emission standards, the 2002 Highway Diesel Progress Review and the recently released Highway Diesel Progress Review Report 2.[35,36,37,38] The following sections summarize the challenges to applying these technologies to nonroad engines and why we believe the emission standards finalized today are technically feasible in the leadtime provided.

1. Can Advanced Diesel Emission Control Technologies Be Applied to Nonroad Engines and Equipment?

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[35] Regulatory Impact Analysis: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements, United States Environmental Protection Agency, December 2000, EPA420-R-00-026. Copy Available in EPA Air Docket A-2001-28 Item II-A-01.

[36] Regulatory Impact Analysis: Control of Emissions of Air Pollution from Highway Heavy-Duty Engines, United States Environmental Protection Agency, June 2000, EPA420-R-00-010. Copy available in EPA Air Docket A-2001-28 Item II-A-02.

[37] Highway Diesel Progress Review, United States Environmental Protection Agency, June 2002, EPA 420-R-02-016. Copy available in EPA Air Docket A-2001-28 Item II-A-52.

[38] Highway Diesel Progress Review Report 2, United States Environmental Protection Agency, March 2004, EPA420-R-04-004. Copy available in Docket OAR-2003-0012-0918.

The emission standards and the introduction dates for those standards, as described earlier in this section, are premised on the transfer of diesel engine technologies being or already developed to meet light-duty and heavy-duty vehicle standards that begin in 2007. The advanced technology standards that we are finalizing today for engines over 25 horsepower will begin to go into effect four years later. This time lag between equivalent highway and nonroad diesel engine standards is necessary in order to allow time for engine and equipment manufacturers to further develop these highway technologies for nonroad engines and to align this program with nonroad Tier 3 emission standards that begin to go into effect in 2006.

This section summarizes the engineering challenges to applying advanced emission control technologies to nonroad engines and equipment, and why we believe that technologies developed for highway diesel engines can be further refined to address these issues in a timely manner for nonroad engines consistent with the emission standards finalized today.

a. Nonroad Operating Conditions and Exhaust Temperatures

Nonroad equipment is highly diverse in design, application, and typical operating conditions. This variety of operating conditions affects emission control systems through the resulting variety in the torque and speed demands (i.e., power demands). In our proposal, we highlighted the challenge for design and implementation of advanced emission control technologies posed by this wide range in what constitutes typical nonroad operation. Some commenters emphasized their concerns regarding this issue as well, and their belief that these issues make the application of the technology to nonroad infeasible. While we recognize and agree with the commenters regarding the nature of the challenges, we disagree with their conclusion regarding feasibility because, as described in the following section, we see a clear path to overcome the challenges.

The primary concern for catalyst-based emission control technologies is exhaust temperature. In general, exhaust temperature increases with engine power and can vary dramatically as engine power demands vary. For catalyzed diesel particulate filters (CDPFs), exhaust temperature determines the rate of filter regeneration, and if too low, causes a need for supplemental means to ensure proper filter regeneration. In the case of the CDPF, it is the aggregate soot regeneration rate that is important, not the regeneration rate at any particular moment in time. A CDPF controls PM emissions under all conditions and can function properly (i.e., not plug) even when exhaust temperatures are low for an extended time and the regeneration rate is lower than the soot accumulation rate, provided that occasionally exhaust temperatures and thus the soot regeneration rate are increased enough to regenerate the CDPF. Similarly, there is a minimum temperature (e.g., 200˚ C) for NO_X adsorbers below which NO_X regeneration is not readily possible and a maximum temperature (e.g., 500˚ C) above which NO_X adsorbers are unable to effectively store NO_X. Therefore, there is a need to match diesel exhaust temperatures to conditions for effective catalyst operation under the various operating conditions of nonroad engines.

Although the range of products for highway vehicles is not as diverse as for nonroad equipment, the need to match exhaust temperatures to catalyst characteristics is still present. This is an important concern for highway engine manufacturers and has been a focus of our ongoing 2007 diesel engine progress review. There we have learned that substantial progress is being made to broaden the operating temperature window of catalyst technologies while at the same time to design engine systems to better control average exhaust temperatures (for ongoing catalyst performance) and to attain periodically higher temperatures (to control PM filter regeneration and NO_X adsorber desulfation). Highway diesel engine manufacturers are working to address this need through modifications to engine design, modifications to engine control strategies, and modifications to exhaust system designs. New engine control strategies designed to take advantage of engine and exhaust system modifications can be used to manage exhaust temperatures across a broad range of engine operation. The technology solutions being developed for highway engines to better manage exhaust temperature are built upon the same emission control technologies (i.e., advanced air handling systems and electronic fuel injection systems) that we expect nonroad engine manufacturers to use in order to comply with the existing Tier 3 emission standards.

Matching the emission control technology and the operating temperature window of the broad range of nonroad equipment may be somewhat more challenging for nonroad engines than for many highway diesel engines simply because of the diversity in equipment design and equipment use. Nonetheless, the problem has been successfully solved in highway applications facing low exhaust temperature performance situations as difficult to address as any encountered by nonroad applications. The most challenging temperature regime for highway engines are encountered at very light-loads as typified by congested urban driving with periods of extended idle operation. Under congested urban driving conditions, exhaust temperatures may be too low for effective NO_X reduction with a NO_X adsorber catalyst. Similarly, exhaust temperatures may be too low to ensure passive CDPF regeneration. To address these concerns, light-duty diesel engine manufacturers have developed active temperature management strategies that provide effective emissions control even under these difficult light-load conditions. Toyota has shown with their prototype diesel particulate NO_X reduction (DPNR) vehicles that changes to EGR and fuel injection strategies can realize an increase in exhaust temperatures of more than 100˚F under even very light-load conditions allowing the NO_X adsorber catalyst to function under these normally cold exhaust conditions.[39] Similarly, PSA Peugeot Citroen (PSA) has demonstrated effective CDPF regeneration under demanding light-load taxi cab conditions with current

[39] Sasaki, S., Ito, T., and Iguchi, S., "Smoke-less Rich Combustion by Low Temperature Oxidation in Diesel Engines," 9th Aachener Kolloquim Fahrzeug - und Motorentechnik 2000. Copy available in EPA Air Docket A-2001-28 Item II-A-56.

production technologies.[40] Both of these are examples of technology paths available to nonroad engine manufacturers to increase temperatures under light-load conditions.

While a number of commenters expressed concerns about low temperature operation for nonroad equipment, no commenters provided data showing that nonroad equipment in-use operating cycles would be more demanding of low temperature performance than passenger car urban driving. Both the Toyota and PSA systems are designed to function even with extended idle operation as would be typified by a taxi waiting to pick up a fare.

It is our conclusion that by actively managing exhaust temperatures, for example through engine management to increase exhaust temperatures, engine manufacturers can ensure highly effective catalyst-based emission control performance (i.e., compliance with the emission standards across the applicable tests) and reliable filter regeneration across a wide range of engine operation as would be typified by the broad range of in-use nonroad duty cycles. Active methods of regenerating PM filters have been shown to be reliable under all operating conditions and can be applied to nonroad diesel engines in the time frame required by these regulations. The additional cost for active regeneration, beyond the cost for the PM filter alone, has been accounted for in the cost analysis summarized in section VI of this preamble.

We have conducted an analysis of various nonroad equipment operating cycles and various nonroad engine power density levels to better understand the matching of nonroad engine exhaust temperatures, catalyst installation locations and catalyst technologies. This analysis, documented in the RIA, shows that for many engine power density levels and equipment operating cycles, exhaust temperatures are quite well matched to catalyst temperature window characteristics. In particular, the nonroad transient cycle (NRTC), the cycle we are finalizing to use for certification for most engines with rated power less than 750 hp, was shown to be well matched to the NO_X adsorber characteristics with estimated performance in excess of 90 percent for a turbocharged diesel engine tested under a range of power density levels. The analysis also indicated that the exhaust temperatures experienced over the NRTC are better matched to the NO_X adsorber catalyst temperature window than the temperatures that would be expected over the highway FTP test cycle. This suggests (when coupled with the fact that PM filters function with equal effectiveness at essentially all conditions) that compliance based on testing with the nonroad Tier 4 standards on the NRTC will be somewhat easier, using similar technology, than complying with the highway 2007 emission standards on the highway transient test cycle.

In sum, we believe based on our analysis of nonroad engines and equipment operating characteristics, that, in use, some nonroad engines will experience conditions that require the use of temperature management strategies (e.g., active regeneration) in order to effectively use the NO_X adsorber and CDPF systems. We have assumed in our cost analysis that all nonroad

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[40] Jeuland, N., et al, "Performances and Durability of DPF (Diesel Particulate Filter) Tested on a Fleet of Peugeot 607 Taxis First and Second Test Phases Results," October 2002, SAE 2002-01-2790.

engines complying with a PM standard of 0.03 g/bhp-hr or lower will have an active means to control temperature (i.e. we have costed a backup regeneration system, although some applications likely may not need one). We have made this assumption believing, as indicated by a number of commenters, that manufacturers will not be able to accurately predict in-use conditions for every piece of equipment and will thus choose to provide the technologies on a back-up basis. As explained earlier, the technologies necessary to accomplish this temperature management are enhancements of both the Tier 3 emission control technologies that will form the starting point for Tier 4 engines larger than 50 hp, and the control strategies being developed for highway diesel engines.[41] Based on our analyses, we believe that there are no nonroad engine applications above 25 horsepower for which these highway engine approaches for temperature management will not work. However, we agree with commenters that given the diversity in nonroad equipment design and application, additional time will be needed in order to match the engine performance characteristics to the full range of nonroad equipment.

We have concluded that, given the timing of the emissions standards finalized today, and the availability and continuing development of technologies to address temperature management for highway engines which technologies are transferrable to all nonroad engines with greater than 25 hp power rating, nonroad engines can be designed to meet the new standards in the lead time provided, and can be provided to equipment makers in a timely manner within that lead time.

b. Nonroad Operating Conditions and Durability

Nonroad equipment is designed to be used in a wide range of tasks, from mining equipment to crop cultivation and harvesting to excavation and loading, and operated in harsh environments. In the normal course of equipment operation the engine and its associated hardware will experience levels of vibration, impacts, and dust that may exceed conditions typical of highway diesel vehicles. For this reason, some commenters said that the PM filter technology was infeasible for nonroad equipment. We disagree with this assertion and continue to believe that PM filter technologies can be applied to a wide range of nonroad equipment.

Specific efforts to design for the nonroad operating conditions will be required in order to ensure that the benefits of these new emission control technologies are realized for the life of nonroad equipment. Much of the engineering knowledge and experience to address these issues already exists with the nonroad equipment manufacturers. Vibration and impact issues are fundamentally mechanical durability concerns (rather than issues of technical feasibility of achieving emissions reductions) for any component mounted on a piece of equipment (e.g., an engine coolant overflow tank). Equipment manufacturers must design mounting hardware such

[41] We do not have Tier 3 emission standards for engines in the horsepower category from 25-50 hp. However, we expect that similar Tier 3 emission control technologies will form part of the emission control technology package used for compliance with the Tier 4 standards for these engines in 2013. Our cost analysis reflects the additional cost to apply these technologies for NO_X and PM control.

as flanges, brackets, and bolts to support the new component without failure. Further, the catalyst substrate material itself must be able to withstand the conditions encountered on nonroad equipment without itself cracking or failing. There is a large body of real world testing with retrofit emission control technologies on engines up to 750 hp that demonstrate the durability of the catalyst components themselves even in the harshest of nonroad equipment applications. The evidence for even larger engines (i.e., those above 750 hp) is less conclusive because of the limited number of applications.

Deutz, a nonroad engine manufacturer, sold approximately 2,000 diesel particulate filter systems for nonroad equipment in the period from 1994 through 2000. The very largest of these systems were limited to engine sizes below 850 hp. The majority of these systems were sold into significantly smaller applications. Many of these systems were sold for use in mining equipment. Mining equipment is exposed to extraordinarily high levels of vibration, experiences impacts with the mine walls and face, and encounters high levels of dust. Yet in meetings with the Agency, Deutz shared their experience that no system had failed due to mechanical failure of the catalyst or catalyst housing.[42] The Deutz system utilized a conventional cordierite PM filter substrate as is commonly used for heavy-duty highway truck CDPF systems. The canning and mounting of the system was a Deutz design. Deutz was able to design the catalyst housing and mounting in such a way as to protect the catalyst from the harsh environment as evidenced by its excellent record of reliable function.

A number of commenters asserted that it was not possible to apply conventional CDPF technologies (i.e., ceramic wall-flow filter media) to the largest diesel engines with power ratings above 750 hp. In the draft RIA for the proposal, we described our expectation that these highway-based systems could be assembled into larger systems to work well for these largest diesel engines. While we continue to believe that it may be possible in the time frame of this rulemaking for these conventional CDPFs to be applied to engines with more than 750 hp, based on the evidence provided by the commenters, we now agree that too much uncertainty remains for us to reach that conclusion today. We cannot clearly today describe a method to monitor the soot loading of individual filter elements in a parallel system made up of a significant number of smaller components. This is because for parallel systems the pressure drop (the best current method to monitor filter condition) across all of the parallel components is exactly the same. If a single filter begins to plug and needs to be regenerated it may not be detected in such a system. Therefore, we believe that instead of a massively parallel filter system, an alternate PM filtering media may be more appropriate in order to address issues of scalability, durability and packaging for these largest engines. Fortunately, there are other filter media technologies (e.g., wire or fiber mesh depth filters) that can be successfully scaled to any size and which we have confidence in projecting today will be a more appropriate solution for the bulk of the engines in this size

[42] "Summary of Conference Call between U.S. EPA and Deutz Corporation on September 19, 2002 regarding Deutz Diesel Particulate Filter System", EPA Memorandum to Air Docket A-2001-28 Item II-B-31.

category. Because these depth filtration technologies are not quite as efficient at filtering PM as the ceramic systems that are the dominant solution for the smaller highway diesel engines, we are finalizing a set of PM filter-based standards for engines greater than 750 hp which are slightly higher than the proposed PM standards for these engines. Those standards are discussed in sections II.A and II.B.3 below. Our cost estimates summarized in section VI for engines greater than 750 hp are consistent with the use of either silicon carbide or wire mesh PM filter technologies.

Certain nonroad applications, including some forms of harvesting equipment, consumer lawn and garden equipment, and mining equipment, may have specific limits on maximum surface temperature for equipment components in order to ensure that the components do not serve as ignition sources for flammable dust particles (e.g. coal dust or fine crop/lawn dust). Some commenters have raised concerns that these design constraints might limit the equipment manufacturers ability to install advanced diesel catalyst technologies such as NO_X adsorbers and CDPFs. This concern seems to be largely based upon anecdotal experience with gasoline catalyst technologies where under certain circumstances catalyst temperatures can exceed 1,000˚C and without appropriate design considerations could conceivably serve as an ignition source. We do not believe that these concerns are justified in the case of either the NO_X adsorber catalyst or the CDPF technology. Catalyst temperatures for NO_X adsorbers and CDPFs should not exceed the maximum exhaust manifold temperatures already commonly experienced by diesel engines (i.e, catalyst temperatures are expected to be below 800˚C).[43] CDPF temperatures are not expected to exceed approximately 700˚C in normal use and are expected to only reach the 650˚C temperature during periods of active regeneration. Similarly, NO_X adsorber catalyst temperatures are not expected to exceed 700˚C and again only during periods of active sulfur regeneration as described in section III.C below. Under conditions where diesel exhaust temperatures are naturally as high as 650˚C, no supplemental heat addition from the emission control system will be necessary for regeneration and therefore exhaust temperatures will not exceed their natural level. When natural exhaust temperatures are too low for effective emission system regeneration then supplemental heating, as described earlier, may be necessary but would not be expected to produce temperatures higher than the maximum levels normally encountered in diesel exhaust. Furthermore, even if it were necessary to raise exhaust temperatures to a higher level in order to promote effective emission control, there are technologies available to isolate the higher exhaust temperatures from flammable materials such as dust. One approach would be the use of air-gapped exhaust systems (i.e., an exhaust pipe inside another concentric exhaust pipe separated by an air-gap) that serve to insulate the inner high temperature surface from the outer surface which

[43] The hottest surface on a diesel engine is typically the exhaust manifold which connects the engines exhaust ports to the inlet of the turbocharger. The hot exhaust gases leave the engine at a very high temperature (800˚C at high power conditions) and then pass through the turbocharger where the gases expand driving the turbocharger providing work. The process of extracting work from the hot gases cools the exhaust gases. The exhaust leaving the turbocharger and entering the catalyst and the remaining pieces of the exhaust system is cooler (as much as 200˚C at very high loads) than in the exhaust manifold.

could come into contact with the dust. The use of such a system also may be desirable in order to maintain higher exhaust temperatures inside the catalyst in order to promote better catalyst function. Another technology to control surface temperature already used by some nonroad equipment manufacturers is water cooled exhaust systems.[44] This approach is similar to the air-gapped system but uses engine coolant water to actively cool the exhaust system.

We thus do not believe that flammable dust concerns will prevent the use of either a NO_X adsorber or a CDPF because catalyst temperatures are not expected to be unacceptably high and because remediation technologies exist to address these concerns. In fact, exhaust emission control technologies (i.e., aftertreatment) have already been applied on both an original equipment manufacturer (OEM) basis and for retrofit to nonroad equipment for use in potentially explosive environments. Many of these applications must undergo Underwriters Laboratory (UL) approval before they can be used.[45] Therefore, while we appreciate the commenters' concerns regarding safety, we remain convinced that the application of these emission control technologies will not compromise (or decrease) equipment safety.

We agree that nonroad equipment must be designed to address safety and durable performance for a wide range of operating conditions and applications that would not commonly be experienced by highway vehicles. We believe further as demonstrated by retrofit experiences around the world that technical solutions exist which allow catalyst-based emission control technologies to be applied to nonroad equipment.

2. Are the Standards for Engines 75–750 hp feasible?

There are three primary test provisions and associated standards in the Tier 4 program we are finalizing today. These are the Nonroad Transient Cycle (NRTC), the existing International Organization for Standardization (ISO) C1 steady-state cycle, and the highway-based Not-To-Exceed (NTE) provisions.[46] Under today's rules, most nonroad diesel engines must meet the new standards for each of these three test cycles (the exceptions are noted below). Compliance

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[44] "Engine Technology and Application Aspects for Earthmoving Machines and Mobile Cranes, Dr. E. Brucker, Liebherr Machines Bulle, SA, AVL International Commercial Powertrain Conference, October 2001. Copy available in EPA Air Docket A-2001-28, Docket Item # II-A-12.

[45] Phone conversation between Byron Bunker, United States Environmental Protection Agency and Dale McKinnon, Manufacturers of Emission Control Association (MECA), 9 April, 2003 confirming the use of emission control technologies on nonroad equipment used in coal mines, refineries, and other locations where explosion proofing may be required.

[46] As an alternative to compliance with the ISO C1 test procedure, a manufacturer can show compliance with the standards by testing over the Ramped Modal Cycle (RMC) as described in section III.F.

on the transient test cycle includes weighting the results from a cold start and hot start test with the cold start emissions weighted at 1/20 and hot start emissions weighted at 19/20. Additionally, we have alternative optional test cycles including the existing ISO-D2 steady-state cycle and the Transportation Refrigeration Unit (TRU) cycle which a manufacturer can choose to use for certification in lieu of the NRTC and the ISO-C1, provided that the manufacturer can demonstrate to the Agency that the engine will only be used in a limited range of nonroad equipment with known operating conditions. A complete discussion of these various test cycles can be found in chapter 4.2, 4.3, and 4.4 of the RIA.

The standards we are finalizing today for nonroad engines with rated power from 75 to 750 hp are based upon the performance of technologies and standards for highway diesel engines which go into effect in 2007. As explained above, we believe these technologies, namely NO_X adsorbers and catalyzed diesel particulate filters enabled by 15 ppm sulfur diesel fuel, can be applied to nonroad diesel engines in a similar manner as for highway diesel engines. The combustion process and the means to modify that process are fundamentally the same for highway and nonroad diesel engines regardless of engine size. The formation mechanism and quantity of pollutants formed in diesel engines are fundamental characteristics of engine design and are not inherently different for highway and nonroad engines regardless of engine size. The effectiveness of NO_X adsorbers to control NO_X emissions and CDPFs to control PM, NMHC, and CO emissions are determined by fundamental catalyst and filter characteristics. Therefore, we disagree with commenters who suggest that these highway technology based emission standards are infeasible for nonroad engines. We acknowledge the comments raised regarding the unique characteristics nonroad diesel engines which must be considered in setting these standards, and we have addressed those issues by allowing (where appropriate) for additional lead time or slightly less stringent standards for nonroad diesel engines in comparison to highway diesel engines (and likewise have made appropriate cost estimates to account for the technology and engineering needed to address these issues).

PM Standard

We are finalizing a PM standard for engines in this category of 0.01 g/bhp-hr based upon the emissions reductions possible through the application of a CDPF and 15ppm sulfur diesel fuel. This is the same emissions level as for highway diesel engines in the heavy-duty 2007(HD2007) program (66 FR 5001, January 18, 2001). While emission levels of engine-out soot (the solid carbon fraction of PM) may be somewhat higher for some nonroad engines when compared to highway engines, these emissions are virtually eliminated (reduced by 99 percent) by the CDPF technology. With application of the CDPF technology, the soluble organic fraction (SOF) portion of diesel PM is predicted to be all but eliminated. The primary emissions from a CDPF equipped engine are sulfate PM emissions formed from sulfur in diesel fuel. The emissions rate for sulfate PM is determined primarily by the sulfur level of the diesel fuel and the rate of fuel consumption. With the 15 ppm sulfur diesel fuel, the PM emissions level from a CDPF equipped nonroad diesel engine will be similar to the emissions rate of a comparable highway diesel engine. Therefore, the 0.01 g/bhp-hr emission level is feasible for nonroad

engines tested on the NRTC cycle and on the steady-state cycles, ISO-C1 and ISO-D2. Put another way, control of PM using CDPF technology is essentially independent of duty cycle given active catalyst technology (for reliable regeneration and SOF oxidation), adequate control of temperature (for reliable regeneration) and low sulfur diesel fuel (for reliable regeneration and low PM emissions). While some commenters argued that PM filters will not enable the 0.01 PM emission standard for nonroad engines, we remain convinced by the demonstration of 0.01 or lower PM emission levels from a number of diesel engines described in the RIA, that the standard is feasible given the leadtime provided and the availability of 15 ppm sulfur diesel fuel. Likewise, the NTE provisions for nonroad engines are the same as for on-highway engines meeting an equivalent PM control level. The maximum PM emission level from a CDPF equipped diesel engine is primarily determined by the maximum fuel sulfur conversion level experienced at the highest operating conditions. As documented in RIA chapter 4.1.1.3, testing of diesel engines at conditions representative of the highest sulfate PM formation rates shows PM levels below the level required by the NTE provisions when tested on less than 15 ppm sulfur diesel fuel.

NO_X Standard

We are finalizing a NO_X standard of 0.30 g/bhp-hr for engines in this category based upon the emission reductions possible from the application of NO_X adsorber catalysts and the expected emission levels for Tier 3 compliant engines which form the baseline technology for Tier 4 engines. The Tier 3 emission standards are a combined NMHC+NO_X standard of 3.0 g/bhp-hr for engines greater than 100 hp and less than 750 horsepower. For engines less than 100 hp but greater than 50 horsepower the Tier 3 NMHC+NO_X emission standard is 3.5 g/bhp-hr. We believe that in the time-frame of the Tier 4 emission standards, all engines from 75 to 750 hp can be developed to control NO_X emissions to engine-out levels of 3.0 g/bhp-hr or lower.[47] This means that all engines will need to apply Tier 3 emission control technologies (i.e., turbochargers, charge-air-coolers, electronic fuel systems, and for some manufacturers EGR systems) to get to this baseline level. As discussed in more detail in the RIA, our analysis of the NRTC and the ISO-C1 cycles indicates that the NO_X adsorber catalyst can provide a 90 percent or greater NO_X reduction level on the cycles. The standard of 0.30 g/bhp-hr reflects a baseline emissions level of 3.0 g/bhp-hr and a greater than 90 percent reduction of NO_X emissions through the application of the NO_X adsorber catalyst. The additional lead time available to nonroad engine manufacturers and the substantial learning that will be realized from the introduction of these same technologies to highway diesel engines, plus the lack of any fundamental technical impediment, makes us confident that the new NO_X standards can be met.

[47] For engines between 75 and 100 horsepower, this may require re-optimization of the engine to lower NO_X emissions if they are higher than 3.0, but we would not expect any new hardware beyond the Tier 3 hardware to be required in the Tier 4 timeframe to accomplish this reduction.

Given the fundamental similarities between highway and nonroad diesel engines, we believe that the NO_X adsorber technology developed for highway engines can be applied with equal effectiveness to nonroad diesel engines with additional developments in engine thermal management (as discussed in section II.B.2 above) to address the more widely varied nonroad operating cycles. In fact, as discussed previously, the NO_X adsorber catalyst temperature window is particularly well matched to transient operating conditions as typified by the NRTC.

As pointed out by some commenters, compliance with the NTE provisions will be challenging for the nonroad engine industry due to the diversity of nonroad products and operating cycles. However, the technical challenge is reduced somewhat by the 1.5 multiplier used to calculate the NTE standard as discussed in section III.J. Controlling NO_X emissions under NTE conditions is fundamentally similar for both highway and nonroad engines. The range of control is the same and the amount of reduction required is also the same. We know of no technical impediment, nor were any raised by commenters, that would prevent achieving the NTE standard under the zone of operating conditions required by the NTE.

NMHC Standard

Meeting the NMHC standard under the lean operating conditions typical of the biggest portion of NO_X adsorber operation should not present any special challenges to nonroad diesel engine manufacturers. Since CDPFs and NO_X adsorbers contain platinum and other precious metals to oxidize NO to NO_2, they are also very efficient oxidizers of hydrocarbons. NMHC reductions of greater than 95 percent have been shown over transient and steady-state test procedures.[48] Given that typical engine-out NMHC is expected to be in the 0.40 g/bhp-hr range or lower for engines meeting the Tier 3 standards, this level of NMHC reduction will mean that under lean conditions emission levels will be well below the standard. For the same reasons, there is no obstacle which would prevent achieving the NTE standard.

Under the brief episodic periods of rich operation necessary to regenerate NO_X adsorber catalysts, it is possible to briefly experience higher levels of NMHC emissions. Absent a controlling standard, it is possible that these NMHC emissions could be high. There are two possible means to control the NMHC emissions during these periods in order to meet the NMHC standard finalized today. Manufacturers can design the regeneration system and the oxygen storage (oxidation function under rich conditions) of the NO_X adsorber catalyst such that the NMHC emissions are inherently controlled. This is similar to the control realized on today's three-way automotive catalysts which also experience operation that toggles between rich and lean conditions. Secondly, a downstream clean-up catalyst can be used to oxidize the excess NMHC emissions to a level below the standard. This approach has been used in the NO_X

[48] "The Impact of Sulfur in Diesel Fuel on Catalyst Emission Control Technology," report by the Manufacturers of Emission Controls Association, March 15, 1999, pp. 9 & 11. Copy available in EPA Air Docket A-2001-28 Item II-A-67.

adsorber demonstration program at EPA described in the RIA. Our cost analysis for engines in the 75 to 750 hp category includes a cost for a clean-up catalyst to perform this function.

Cold Start

The standards include a cold start provision for the NRTC procedure. This means that the results of a cold start transient test will be weighted with the emissions of a hot start test in order to calculate the emissions for compliance against the standards. In a change from the proposed rule, the weightings are 1/20 cold start and 19/20 for the hot start (as opposed to the proposed weightings of 1/10 and 9/10, respectively) as described more fully in chapter 4.2 of the RIA and section III.F below. Because exhaust temperatures are so important to catalyst performance, a cold start provision is an important tool to ensure that the emissions realized in use are consistent with the expectations of this program. Achieving this standard represents an additional technical challenge for NO_X control and to a lesser extent CO and NMHC control (i.e., control of gaseous pollutants). PM control with a CDPF is not expected to be significantly impacted by cold-start provisions due to the primary filter mechanism being largely unaffected by temperature.

With respect to achievability of the NO_X, CO and NMHC standards, during the initial start and warmup period for a diesel engine, the exhaust temperatures are typically below the light-off temperature of a catalyst. As a result, exhaust stack emissions may initially be higher during this period of operation. The cold start test procedure is designed to quantify these emissions to ensure that emission control systems are designed appropriately to minimize the contribution of cold-start emissions. Cold-start emissions can be minimized by improving catalyst technology to allow for control at lower exhaust temperatures (i.e., by lowering the catalyst light-off temperature) and by applying strategies to quickly raise the exhaust temperature to a level above the catalyst light-off temperature.

There are number of technologies available to the engine manufacturer to promote rapid warmup of the exhaust and emission control system. These include retarding injection timing, increasing EGR, and potentially late cycle injection, all of which are technologies we expect manufacturers to apply as part of the normal operation of the NO_X adsorber catalyst system. These are the same technologies we expect highway engine manufacturers to use in order to comply with the highway cold start FTP provision which weights cold start emissions more heavily with a 1/7 weighting. As a result, we expect the transfer of highway technology to be well matched to accomplish this control need for nonroad engines as well. Using these technologies we expect nonroad engine manufacturers to be able to comply with the new Tier 4 NO_X, CO, and NMHC emission standards including the cold start provisions of the transient test procedure.

One commenter has raised the concern that if diesel engines are no cleaner than 3 g/bhp-hr NO_X and if NO_X adsorbers can be no more efficient than 90 percent, then any increase in NO_X emissions above the 0.30 g/bhp-hr level on a cold-start test will make the emission standards infeasible. We should clarify, when discussing the emission reduction potential of the NO_X

adsorber catalyst generically in the NPRM, we have sometimes simply stated that it is 90 percent or more effective without plainly saying that this refers to our expectation for average performance considering both cold and hot start emissions. More precisely then, we would expect lower effectiveness over the cold-start test procedure with somewhat higher effectiveness realized over the hot-start test procedure. Because of the relative weightings of the two test cycles (i.e., 1/20 for the cold-start and 19/20 for the hot-start), although the degradation of performance below 90 percent over the cold-start cycle can be substantially greater than the performance above 90 percent realized over the hot-start cycle, the standards remain feasible. For example, even if the average NO_X adsorber performance over the cold-start test cycle was only 70 percent, the average NO_X adsorber performance over the hot-start portion of the test cycle would only need to be 91 percent in order to realize a weighted average performance of 90 percent. Similarly, were the cold-start test cycle performance only 50 percent, the hot-start performance would only need to be 92 percent in order to realize a weighted average performance of 90 percent.[49] We are confident, based on our estimates of NO_X adsorber performance over the nonroad test cycle summarized in the RIA, that NO_X adsorber performance in excess of 92 percent can be expected in the time frame of the requirements finalized today.

Complying with the PM standard given consideration of the cold start test procedure is not expected to be as challenging as compliance with the NO_X standard. The effectiveness for PM filtration is not significantly effected by exhaust temperatures, as noted earlier. Thus, PM emission levels are similar over the cold and hot start tests.

The standards that we are finalizing today for nonroad engines with rated horsepower levels from 75 to 750 hp are based upon the same emission control technologies, clean 15ppm or lower sulfur diesel fuel, and relative levels of emission control effectiveness as the HD 2007 emission standards. We have given consideration to the diversity of nonroad equipment for which these technologies must be developed and the timing of the Tier 3 emissions standards in determining the appropriate timing for the Tier 4 standards. Based upon the availability of the emission control technologies, the proven effectiveness of the technologies to control diesel emissions to these levels, the technology paths identified here to address constraints specific to nonroad equipment, and the additional lead time afforded by the timing of the standards, we have concluded that the standards are technically feasible in the leadtime provided.

3. Are the Standards for Engines above 750 hp Feasible?

The preceding discussion of the standards for engines of 75 to 750 hp highlights the main thrust of our new Tier 4 program, a focus on realizing very low on-highway like emission levels for the vast majority of nonroad diesel engines. The emission standards and the combination of

[49] The combined weighted average performance is calculated as 1/20 (cold-start) + 19/20 (hot-start). Hence it can be seen that 1/20 (70%) + 19/20 (91%) = 90% and likewise that 1/20 (50%) + 19/20 (92%) = 90%.

technologies that we expect will be used to meet those standards are virtually identical to the HD2007 program for on-highway engines. The following three sections (II.B.3, II.B.4, and II.B.5) describing the feasibility of the standards for engines above 750 hp, from 25 to 75 hp, and below 25 hp, while following the same pattern and objective, take additional consideration of the fact that engines and equipment in these size categories have no direct on-highway equivalent and differ from highway engines in substantial ways that cause us to reach differing conclusions regarding the appropriate standards and timing for those standards. Whether in scale, or use, or operating conditions, the characteristics of these engines and equipment are such that we have taken particular consideration of them in setting the timing and level of the standards. The remainder of this section (II.B.3) discusses what makes the above 750 hp category unique and why the standards which we are adopting are technologically feasible.

a. What makes the over 750 hp category different?

The first and most obvious difference for engines in this horsepower category is scale. No on-highway engines come close to the size of the largest engines in this category which can produce in excess of 3,000 horsepower, consist of 16 or more cylinders and have 12 or more turbochargers. The engines, and the equipment that they power, are quite simply significantly larger than any on-highway diesel engine. Many commenters argued that emission technologies from on-highway vehicles could not be simply scaled up for these larger engines and that if they were, the consequences of this resizing would include structural weakness and reduced system robustness. As discussed below, our review of the information provided with these comments and our subsequent analysis of the technical characteristics of some emission control components has led us to conclude that revised emission standards (based on performance of different technologies that those whose performance formed the basis for the proposed rule) from those we proposed for this horsepower category are appropriate and available.

We have concluded that it is appropriate to distinguish between two broad categories of engines over 750 hp grouped by application: mobile machines and generator sets. Mobile machines include the very largest nonroad equipment used in mining trucks and large excavation equipment. The environment and operating conditions (especially for vibration) represent the harshest application into which nonroad engines are applied. Design considerations for technologies used to control emissions from engines in these applications must first consider robustness to the harsh environments that will be experienced in use. In contrast, mobile nonroad generator sets operate in relatively good operating environments. In addition, while mobile nonroad generator sets can, and are moved between operating locations, they are always stationary during actual operation. Thus the levels of vibration and the general environment for engine operation are significantly less demanding for generator sets than for mobile machines. Also the dynamic range of operation is significantly narrower and less demanding for generator sets. Designed to operate at a set engine speed, synchronous to the frequency cycle desired for electric generation (i.e., 1200 or 1800 RPM for 60hz), diesel engines designed for generator set applications can be optimized for operation in this narrow range.

We have given specific consideration to the unique engineering challenges for engines in this horsepower category in determining the appropriate emission standards set in today's action. We have also taken into account the important differences between generator set applications and other mobile applications in developing standards for this horsepower category.

b. Are the new Tier 4 standards for over 750 hp engines technologically feasible?

The emission standards described in section II.A above describe a comprehensive program for engines over 750 hp that give consideration to both the physical size of these engines and the applications into which these engines are applied. Engines in this power category must show compliance with the C1 or D2 steady-state test cycles as appropriate as well as with the NTE provisions finalized today. As described in sections III.F and III.G, these engines will not be tested over the NRTC nor will they be subject to a cold-start test procedure. The feasibility discussion in this section describes expected performance of the engines over the required test cycles and the NTE. This section will briefly summarize the feasibility analysis contained in the RIA for these engines.

PM Standards

Beginning in 2011 all nonroad diesel engines above 750 hp must meet a PM standard of 0.075 g/bhp-hr. We believe that this PM standard is feasible based on the substantial reductions in sulfate PM due to the use of 15 ppm sulfur diesel fuel and the potential to improve the combustion process to reduce PM emissions formed in the engine. Specifically, we believe based on the evidence in the RIA that increasing fuel injection pressure, improving electronic controls and optimizing the combustion system geometry will allow engine manufacturers to meet this level of PM control in 2011. Some engine manufacturers have in fact indicated to the Agency that this level of control represents an achievable goal by 2011. One commenter argued however, that a more relaxed standard of 0.1 g/bhp-hr based on today's on-highway diesel engine performance would be appropriate. We disagree with this comment, believing that given the substantial leadtime available and the potential for further improvements in combustion systems, that it is appropriate to set a forward looking PM standard of 0.075 g/bhp-hr. Conversely, other commenters argued that future on-highway PM filter technology should be applied to this class of engines as early as 2011 (i.e., that a standard of 0.01 g/bhp-hr PM is appropriate). While we agree with the commenters that in the long-term it will be appropriate to apply filter-based emission control technologies to these engines, we do not agree that such control is appropriate as early as 2011. As the following section explains, we believe that there are remaining technical challenges to be addressed prior to the application of PM filters to these engines and that it is necessary to allow additional leadtime for those challenges to be addressed.

Beginning in 2015 all nonroad engines over 750 hp must meet stringent PM filter technology-based emission standards of 0.02 g/bhp-hr for engines used in generator set applications and 0.03 g/bhp-hr for engines used in mobile machine applications. We are predicating these emission standards based on the application of a different form of diesel

particulate filter technology, a wire or fiber mesh depth filter rather than a ceramic wall flow filter. Wire mesh filters are capable of reducing PM by 70 percent or more. We have not based these standards upon the more efficient (>90 percent) control possible from ceramic wall flow style PM filters, because we believe that the application of the wall flow filter technology on engines of this size has not been adequately demonstrated at this time. While it would certainly be possible to apply the ceramic-based technology to these larger engines, we cannot today conclude with certainty that such systems would be as robust in-use as needed (see earlier discussion in section II.B.1.b). Considering the information available to the Agency today, we believe it appropriate to set the long term PM standard for these very large engines based on technologies which we can project with confidence will give high levels of emission reduction, durability, and robustness when scaled to these very large engine sizes.

The 0.01 g/bhp-hr difference in the PM emission standards between the standard for generator sets and for other mobile applications in this category (0.01 g/bhp-hr lower for generator sets) reflects our expectation that engine-out emissions from generator sets can be reduced below the level for mobile machines due to generator set operation at a single engine speed. Without the need to provide full power and control over the wider range of possible operating conditions that mobile machines must deliver, we believe that the air handling systems (especially the turbocharger match to the engine) can be improved to provide a moderate reduction in engine-out emissions. This, coupled with the reduction afforded by the PM filter technology, would allow generator sets to meet a more stringent 0.02 g/bhp-hr standard. Diesel engines designed for use in generator sets meeting this standard will need to demonstrate compliance over the appropriate test cycles, either the ISO C1 or D2 tests. As discussed in RIA chapter 4.3.6.2, PM emission rates are nearly the same for steady-state testing or for alternative ramped modal cycle (RMC) testing. These test cycles, like the engines, are designed to be representative of the range of operation expected from a generator set.

As discussed previously, PM emission control over the NTE region for PM filter equipped diesel engines is predominantly a function of sulfate formation at high exhaust temperatures. Given that fuel consumption (and thus sulfur) consumption rates on a brake specific basis tend to be lower for engines above 750hp, we can conclude that the increase in PM emissions over the NTE region will likely be lower for these engines than for engines meeting the 0.01 g/bhp-hr standard. Thus, we can conclude based on the evidence in the RIA that compliance with the NTE provisions for PM is feasible for engines over 750 hp.

Although we are projecting that manufacturers will comply with this standard using a slightly less efficient PM filter technology, we remain convinced that 15 ppm sulfur diesel fuel will still be a necessity for this technology to be applied. Regardless of the filter media chosen for the PM filter, the filter will still require catalyst-based systems to ensure robust regeneration and adequate control of the SOF portion of PM. As these catalyst-based technologies are adversely impacted by sulfur in diesel fuel as described in II.C below, 15 ppm sulfur diesel fuel will be required in order to ensure compliance with the PM standards finalized here for engines over 750 hp.

NO_X Standards

As with the PM standards, we are setting distinct NO_X standards for this category of engines reflecting particular concerns with the application of technologies to engines of this size and our desire to realize significant NO_X reductions as soon as possible. There are two sets of NO_X standards that we are finalizing today, a 0.50 g/bhp-hr NO_X standard for engines used in generator set applications and a 2.6 g/bhp-hr NO_X standard for mobile machines.

For engines used in generator set applications we are finalizing a 0.50 g/bhp-hr standard that goes into effect for engines above 1,200 hp in 2011 and in 2015 for engines above 750 hp. We see two possible technology options for manufacturers to meet these standards. First, compliance with this NO_X standard will be possible through the application of a dual bed NO_X adsorber system (i.e., a system that allows regeneration to be controlled external to the engine). This approach can work well for generator set applications where packaging constraints and vibration issues are greatly reduced. Since this approach requires limited engine redesign, it would be an appealing approach for these large engines sold in very low volumes. NO_X adsorber systems for stationary power generation (systems that never move) are available today on a retrofit basis, and we believe with further development to address packaging and durability concerns that similar systems can be applied to mobile generator sets.[50]

A second possible technology option for engines in this category is urea SCR. The challenges for urea SCR in mobile applications are well known, specifically a lack of urea infrastructure to provide urea refill at diesel fueling locations and a need to ensure that urea is added as necessary in use.[51] These hurdles can be addressed more easily for generator sets than for virtually any other mobile source emission category. Although nonroad generator sets are mobile, in operation they remain at a fixed location where fuel is delivered to them periodically (i.e., a 1,200 hp generator set does not and cannot pull into the local truck stop for a fuel fill). Therefore, the same infrastructure that currently provides urea delivery for stationary power generation can also be utilized for nonroad generator set applications.[52] It would still remain for the manufacturer to develop a mechanism to ensure urea refill, but we believe it is likely that solutions to this problem can be addressed through monitoring as for stationary source emissions or other technology options (e.g., a urea interlock that precludes engine operation without the presence of urea).

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[50] Emerachem EMx™ Datasheet - Describing the EMx IC (Internal Combustion) System Air Docket OAR-2003-0012-0948.

[51] See for example 68 FR 28375, May 23, 2003.

[52] Fleetguard StableGuard™ Urea Premix for use with SCR NO_X Reduction Systems, Air Docket A-2001-28 Item IV-A-04.

Either of these technology approaches could be applied to realize an approximately 90 percent reduction from the current Tier 2 emission levels for these engines in order to comply with an emission standard of 0.50 g/bhp-hr. The 0.50 g/bhp-hr standard is different from our proposed level of 0.30 g/bhp-hr reflecting the changes we have made in this final action to the implementation schedule for this class of engines and therefore our projections for a technology path. At the time of the proposal, we projected that this class of engine would follow an integrated two-step technology path. We are now finalizing a program that anticipates the application of 90 percent effective NO_X control to diesel engines for use in generator sets without a reduction in engine-out NO_X levels beyond Tier 2. This reflects our desire to focus on getting the largest emission reduction possible in the near term (beginning in 2011) from these engines. Where we believe additional technology development is needed, as is the case for mobile machines over 750 hp, we are finalizing a more gradual emission reduction technology pathway anticipating further reductions in engine-out NO_X emissions followed by a possible future action to reduce emissions further as described in section II.A. RIA chapter 4.1.2.3.3 describes NO_X adsorber effectiveness to control NO_X emissions including effectiveness over the NTE region. The discussion there is equally applicable to engines above and below 750 hp regarding NTE performance because the key attribute of NTE performance (exhaust temperature) is similar for engines across the horsepower range.

For engines over 750 hp used in mobile machines (and for 750–1200 hp generator sets from 2011 until 2015) we are setting a new NO_X standard of 2.6 g/bhp-hr beginning in 2011. We are predicating this level of emission control (an approximate 50 percent reduction from Tier 2) on an improved combustion system and proven engine-based NO_X control technologies. Specifically, we believe manufacturers can apply either proven cooled EGR technology, or apply additional levels of engine boost, a limited form of Miller Cycle operation, and increased intercooling capacity for the two-stage turbocharging systems that are used on these engines. The second approach for in-cylinder emissions reductions is similar in description at least to the Caterpillar ACERT technology which we believe could be another path for compliance with this standard. We are projecting a modest increase in heat-rejection to the engine coolant for these in-cylinder emission control solutions and have accounted for those costs in our cost analysis. These approaches for NO_X reduction have been proven for on-highway diesel engines since 2003 including compliance with NTE provisions similar to those for nonroad engines finalized here. We can conclude based on the on-highway experience that the NTE provisions can be met for engines in this horsepower category. One commenter suggested that a standard of 3.5 g/bhp-hr would be achievable in this time frame. As described here, we believe that further emission reductions to 2.6 g/bhp-hr are possible in this time frame. Engine manufacturers have indicated to the Agency that they believe this level of in-cylinder emission control can be realized for these very large diesel engines by 2011. We are deferring any decision on setting aftertreatment based NO_X standards for mobile machinery above 750 hp to allow additional time to evaluate the technical issues involved, as discussed in section II.A.4.

<u>NMHC Standards</u>

We are setting two different NMHC emission standards for engines in this category linked to the technologies used to control PM emissions. We are requiring all engines over 750 hp to meet an NMHC standard of 0.30 g/bhp-hr starting in 2011. As explained earlier, in 2011 all engines over 750 hp must meet a PM emission standard of 0.075 g/bhp-hr. We are projecting that manufacturers will meet this standard through improvements in in-cylinder emission control of PM (in conjunction with use of 15 ppm sulfur diesel fuel). These PM control technologies, increased fuel injection pressure, improved electronic controls and enhanced combustion system designs will concurrently lower NMHC emissions to the NMHC standard of 0.30 g/bhp-hr.

The second step in our NMHC standards is to a level of 0.14 g/bhp-hr, consistent with the standard for on-highway diesels beginning in 2007 and for other nonroad diesel engines from 75 to 750 hp beginning in 2011. This change in NMHC standards is timed to coincide with the requirement that engines over 750 hp meet stringent PM emission standards that we believe will require the use of catalyst-based diesel particulate filter systems. These systems are expected to incorporate oxidation catalyst functions to control the SOF portion of diesel PM and to promote robust soot regeneration within the filter. This same oxidation function is highly effective at controlling NMHC emissions (the RIA documents reductions of more than 80 percent) and will result in a reduction in NMHC emissions below the 0.14 g/bhp-hr standard for these engines. As the high level of NMHC control afforded by the application of this technology is broadly realized across the wide range of diesel engine operation, it will allow for compliance with the NTE provisions as well. Although in practice we expect that NMHC emissions may be lower than the 0.14 g/bhp-hr standard, we have not finalized a more stringent standard for NMHC in order to maintain consistency with the NMHC standard we are finalizing for engines from 75 hp to 750 hp, for which the NMHC standard is in part based on feasibility considerations for NO_X adsorber catalyst systems that use diesel fuel to regenerate themselves (with consequent increased NMHC emissions during regeneration events). We believe this is appropriate considering our expectation that NO_X adsorber technology will be found feasible for all nonroad engines over 750 hp.

4. Are the New Tier 4 Standards for Engines 25–75 hp Feasible?

As discussed in section II.B, our standards for 25–75 hp engines consist of a 2008 transitional standard and long-term 2013 standards. The transitional standard is a 0.22 g/bhp-hr PM standard. The 2013 standards consist of a 0.02 g/bhp-hr PM standard and a 3.5 g/bhp-hr NMHC+NO_X standard.[53] As discussed in section II.A, the transitional standard is optional for 50-75 hp engines, as the 2008 implementation date is the same as the effective date of the Tier 3 standards. Manufacturers may decide, at their option, not to undertake the 2008 transitional PM standard, in which case their implementation date for the 0.02 g/bhp-hr PM standard begins in

[53] The 2013 NO_X+NMHC standard is a new standard only for engines in the 25-50 hp category. For engines in the 50-75 hp category, 3.5 g/bhp-hr NO_X+NMHC is the existing Tier 3 emission standard which will now also apply across the new regulated test cycles (e.g., NRTC).

2012. The remainder of this section discusses what makes the 25-75 hp category unique and why the standards are technologically feasible.

a. What makes the 25–75 hp category unique?

As EPA explained in the proposal, and as discussed in section II.A, one cannot assume that highway technologies are automatically transferable to 25–75 hp nonroad engines. In contrast with 75–750 hp engines, which share similarities in displacement, aspiration, fuel systems, and electronic controls with highway diesel engines, engines in the 25–75 hp category have a number of technology differences from the larger engines. These include a higher percentage of indirect-injection fuel systems, and a low fraction of turbocharged engines (see generally RIA chapter 4.1). The distinction in the under 25 hp category is even more pronounced, with no turbocharged engines, nearly one-fifth of the engines have two cylinders or less, and a significant majority of the engines have indirect-injection fuel systems.

The distinction is particularly marked with respect to electronically controlled fuel systems. These are commonly available in the power categories greater than or equal to 75 hp, but, based on the available certification data as well as our discussions with engine manufacturers, we believe there are very limited numbers, if any, in the 25–75 hp category (and no electronic fuel systems in the less than 25 hp category). The research and development work being performed today for the heavy-duty highway market is targeted at engines which are 4-cylinders or more, direct-injection, electronically controlled, turbocharged, and with per-cylinder displacements greater than 0.5 liters. As discussed in more detail below, as well as in section II.B.5 (regarding the under 25 hp category), these engine distinctions are important from a technology perspective and warrant a different set of standards for the 25–75 hp category (as well as for the under 25 hp category).

b. Are the new Tier 4 standards for 25–75 hp engines technologically feasible?

This section will discuss the technical feasibility of both the interim 2008 PM standard and the 2013 standards. For an explanation and discussion of the implementation dates, please refer to section II.A.

i. 2008 PM Standards[54]

We are today finalizing the interim PM control program as proposed for engines in the power category from 25–75 hp. The new PM standard for 2008 is 0.22 g/bhp-hr over the appropriate steady-state test cycle (the NRTC and NTE do not apply, for the reasons explained

[54] As discussed in section II.B., manufacturers can choose, at their option, to pull-ahead the 2013 PM standard for the 50-75 hp engines to 2012, in which case they do not need to comply with the transitional 2008 PM standard.

below). [55] The standard is premised on the use of 500 ppm sulfur diesel fuel and the potential for improvements in engine-out emission control where possible or the application of a diesel oxidation catalyst (DOC). Some commenters raised concerns that this level of emission control from diesel engines may not be possible in 2008 without fuel cleaner than 500 ppm or without changes in the Tier 3 NMHC+NO_X emission standards. Other commenters, including some engine manufacturers, supported this interim program. As explained in the following sections, we continue to believe that these standards are appropriate and feasible in the leadtime provided.

Engines in the 25–50 hp category must meet Tier 2 NMHC+NO_X and PM standards today. We have examined the model year 2004 engine certification data for engines in the 25–50 hp category. These data indicate that over 35 percent of the engine families meet the 2008 0.22 g/bhp-hr PM standard and 5.6 g/bhp-hr NMHC+NO_X standard (unchanged from Tier 2 in 2008) today (even without 500 ppm sulfur diesel fuel). At the time of the proposal, we had analyzed model year 2002 data for this power range, which at that time indicated approximately 10 percent of the engine families complied with the 2008 requirements. The most recent data for model year 2004 indicates substantial progress has already been made in just the past few year in lowering emissions from these engines. This is primarily due to the implementation of the Tier 2 standards in model year 2004. The model year 2001 certification data also showed the 2008 standard were achievable using a mix of engine technologies (IDI and DI, turbocharged and naturally aspirated) tested on a variety of certification test cycles.[56] A detailed discussion of these data is contained in the RIA.

At the time of the proposal, no certification data was available for engines in the 50-75 hp range, because those engines were not subject to a Tier 1 standard and were not subject to Tier 2 standards until model year 2004. We have now had an opportunity to analyze the model year 2004 certification data for engines in the 50-75 hp range. These data shows that more than 70 percent of the engine families in this power range are capable of meeting the 2008 PM standards today. However, most of these engines do not yet meet the 3.5 g/bhp-hr Tier 3 NMHC+NO_X standard, which is required in 2008. We expect that to comply with the Tier 3 standards, these engines will use technologies such as EGR and electronically controlled fuel injection systems (and we included the costs of these technologies in assessing the costs of the Tier 3 standards). These technologies have been shown to reduce NO_X emissions by 50 percent without increasing PM emissions. The certification data show that for the 70 percent of the engine families which

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[55] However, a manufacturer can choose to comply over the TRU cycle including the associated NTE provisions. Compliance with the NTE for engines selecting to certify on the TRU cycle is straightforward because by the very nature of the products, their operation is directly limited to a small range of operating modes over which compliance with the emission standard has already been shown.

[56] The Tier 1 and Tier 2 standards for this power category must be demonstrated on one of a variety of different engine test cycles. The appropriate test cycle is selected by the engine manufacturer based on the intended in-use application of the engine.

meet the 2008 Tier 4 PM standard (0.22 g/bhp-hr), a NO_X reduction of less than 50 percent is needed for most of these engines to meet the 2008 Tier 4 NMHC+NO_X standard. A detailed discussion of these data is contained in the RIA.

In addition to using known engine-out techniques, we also project that the 2008 standards can be achieved with the use of DOCs. DOCs are passive flow-through emission control devices which are typically coated with a precious metal or a base-metal washcoat. DOCs have been proven to be durable in use on both light-duty and heavy-duty diesel applications. In addition, DOCs have already been used to control carbon monoxide on some nonroad applications.[57] Some commenters raised concerns that DOCs could actual increase PM emissions when used on 500 ppm sulfur diesel fuel due to the potential for oxidation of the sulfur in the fuel to sulfate PM. While we agree with the commenters that sulfur reductions are important to control PM and in the long term that a 15 ppm fuel sulfur level will be the best solution, we disagree with the assertion that the amount of sulfate PM formed from a DOC will be such that compliance with the 0.22 g/bhp-hr standard will be infeasible. While commenters shared data showing increased PM emissions when DOCs are used, we have similarly found data (included in the RIA) that shows an overall reduction in emissions. To understand this discrepancy, it is important to realize that DOCs can be designed for operation on a range of fuel sulfur levels. The lower the fuel sulfur level, the more effective the PM oxidation function, but even at 500 ppm sulfur a properly designed DOC will realize a net reduction in PM emissions. DOCs have been successfully applied to diesel engines for on-highway applications for PM control on 500 ppm fuel since 1994 through careful design of the DOC trading-off PM reduction potential and sulfur oxidation potential. The RIA contains additional analysis describing DOC function, and its expected effectiveness when applied to nonroad diesel engines.

Other commenters argued that the application of DOC to diesel engines in this category would lead to an even greater emission reduction than estimated in our proposal, thus allowing the Agency to finalize a lower PM standard. While we agree that some engines will have lower emissions than required to meet the standard and that in the long term (once 15 ppm fuel is widely available) the PM emissions will be further reduced, we do not believe that an emission level lower than 0.22 g/bhp-hr will be generally feasible in 2008 due to the sulfur level of diesel fuel of 500 ppm sulfur and the potential for sulfate PM formation.

In summary then, there are two likely means by which companies can comply with the interim 2008 PM standard. First, engine manufacturers can comply with this standard using known engine-out techniques (e.g., optimizing combustion chamber designs, fuel-injection strategies). In fact, some fraction of engines already would comply with the emission standard. In addition, some engine manufacturers may choose to use diesel oxidation catalysts to meet this

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[57] EPA Memorandum "Documentation of the Availability of Diesel Oxidation Catalysts on Current Production Nonroad Diesel Equipment," William Charmley. Copy available in EPA Air Docket A-2001-28 Item II-B-15.

standard. Our cost analysis makes the conservative assumption (i.e., the higher cost assumption) that all manufacturers will use DOC catalysts to comply with these emission standards.

Based on the existence of a number of engine families which already comply with the 0.22 g/bhp-hr PM standard (and the 2008 NMHC+NO_X standard), and the availability of well known PM reduction technologies such as engine-out improvements and diesel oxidation catalysts, we project that the 0.22 g/bhp-hr PM standards is technologically feasible by model year 2008.

ii. 2013 Standards

For engines in the 25-50 range, we are finalizing standards commencing in 2013 of 3.5 g/bhp-hr for NMHC+NO_X and 0.02 g/bhp-hr for PM. For the 50–75 hp engines, we are finalizing a 0.02 g/bhp-hr PM standard which will be implemented in 2013, and for those manufacturers who choose to pull-ahead the standard one-year, 2012 (manufacturers who choose to pull-ahead the 2013 standard for engines in the 50–75 range do not need to comply with the transitional 2008 PM standard). A more complete discussion of the options available to manufacturers and the nature of the transitional program can be found in section II.A. These standards are measured using the NRTC and steady-state tests. These engines also will be subject to the NTE starting with the 2013 model year.

<u>PM Standard</u>

For engines in the horsepower category from 25–75 hp, we are finalizing a PM standard of 0.02 g/bhp-hr based on the application of catalyzed diesel particulate filters to engines in this category. We received a wide range of comments on our proposal with some arguing that the emission standard could be met earlier than 2013 and others arguing that while technically possible to apply PM filters to engines in this category, that it was not economically or otherwise practical to do so.

The RIA discusses in detail catalyzed diesel particulate filters, including explanations of how CDPFs reduce PM emissions, and how to apply CDPFs to nonroad engines. We have concluded, as explained above, that CDPFs can be used to achieve the 0.01 g/bhp-hr PM standard for 75–750 hp engines. As also discussed in section II.B.2.a above, PM filters will require active back-up regeneration systems for many nonroad applications above and below 75 hp because low temperature operation is an issue across all power categories. One commenter raised concerns regarding the low exhaust temperatures possibly experienced by small nonroad engines and argued that such low temperatures make PM filter regeneration impossible absent the use of active regeneration technologies. We agree with the commenter that active regeneration, as described previously, may be necessary and have included the cost for such systems in our cost estimates. See section II.B.1.a. A number of secondary technologies are likely required to enable proper regeneration, including possibly electronic fuel systems such as

common rail systems which are capable of multiple post-injections which can be used to raise exhaust gas temperatures to aid in filter regeneration.

Particulate filter technology, with the requisite trap regeneration technology, can also be applied to engines in the 25 to 75 hp range. As explained earlier, the fundamentals of how a filter is able to reduce PM emissions are not a function of engine power, so that CDPF's are just as effective at capturing soot emissions and oxidizing SOF on smaller engines as on larger engines. The PM filter regeneration systems described in section II.B.2 are also applicable to engines in this size range and are likewise feasible. There are specific trap regeneration technologies which we believe engine manufacturers in the 25–75 hp category may prefer over others. For example, some manufacturers may choose to apply an electronically-controlled secondary fuel injection system (i.e., a system which injects fuel into the exhaust upstream of a PM filter). Such a system has been commercially used successfully by at least one nonroad engine manufacturer, and other systems have been tested by technology companies.[58] However, we recognize that the application of these technologies will be challenging and will require additional time to develop. We therefore disagree with commenters who say that the standard could be met sooner and have decided to finalize the implementation schedule as proposed.

As we proposed, we are finalizing a slightly higher PM standard (0.02 g/bhp-hr rather than 0.01) for engines in this power category. As discussed in the preamble to the proposed rule and in some detail in the RIA, with the use of a CDPF, the PM emissions emitted by the filter are primarily derived from the fuel sulfur (68 FR 28389-28390, May 23, 2003). The smaller power category engines tend to have higher fuel consumption per unit of work than larger engines. This occurs for a number of reasons. First, the lower power categories include a high fraction of IDI engines which by their nature consume approximately 15 percent more fuel than a DI engine. Second, as engine displacements get smaller, the engine's combustion chamber surface-to-volume ratio increases. This leads to higher heat-transfer losses and therefore lower efficiency and higher fuel consumption. In addition, frictional losses are a higher percentage of total power for the smaller displacement engines which also results in higher fuel consumption. Because of the higher fuel consumption rate, we expect a higher particulate sulfate level, and therefore we have set a 0.02 g/bhp-hr standard for engines in this power category. We did not receive any comments on our proposal arguing that the technical basis for this higher PM level was inappropriate.

The 0.02 g/bhp-hr standard applies to all of the test cycles applicable to engines in this power category (i.e., the NRTC including cold-start, the ISO C1, D2 and G2 cycles and the alternative TRU and RMC cycles, as appropriate). Our feasibility analysis summarized here and detailed in the RIA takes into consideration these different test cycles. The control technologies

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[58] "The Optimized Deutz Service Diesel Particulate Filter System II," H. Houben et. al., SAE Technical Paper 942264, 1994 and "Development of a Full-Flow Burner DPF System for Heavy Duty Diesel Engines," P. Zelenka et. al., SAE Technical Paper 2002-01-2787, 2002.

work in a similar manner and provide the same high level of emission control across these different operating regimes including the NTE. The most significant effect on emission performance is related to sulfate PM formation at high load, high temperature operating conditions. As the RIA details, this level of high sulfate formation rate is not high enough to preclude compliance with the PM emission standard with 15 ppm fuel sulfur on the regulated test cycles nor is it high enough to preclude compliance with the NTE provisions. At higher fuel sulfur levels however, compliance with the PM emission standard would not be feasible.

The majority of negative comments on our proposal to set a PM standard based on the control possible from PM filter technologies focused on the economic and technical challenges to apply these technologies and the major engine technology enabler, electronic fuel systems, to smaller diesel engines. Some commenters acknowledged that the technologies were "technically feasible" but not economically feasible or practical for engines in this power category. While we acknowledge that the application of these technologies to diesel engines in this horsepower category will be challenging and have given consideration to this in setting the timing for the new standard, we believe that the technical path for compliance is clear and that the cost estimates we have made for these engines accurately represent this technical path. As discussed in the RIA, at the time of the proposal we projected no significant penetration of electronic fuel systems for engines in the 50–100 hp range prior to the Tier 3 standards (2008). Since the proposal, new information regarding model year 2004 engine certifications has become available. That data show 18 percent of the engines in the 75–100 hp category already use electronically controlled fuel systems. In model year 2001, no engines in this category used electronic fuel systems. We believe this strong trend toward the introduction of more advanced electronic fuel system technology will continue in the future and, importantly for engines in the 25–75 hp category, will extend to ever smaller engine categories due to the user benefits provided by the technology and the falling cost for such systems. However, acknowledging the substantial time between now and 2012, and the potential for technologies to mature faster or slower than we are estimating here, we have decided to conduct a technology review of these standards as described in section II.A above. This review will provide EPA with another opportunity to confirm that the technical path laid out here is indeed progressing in a manner consistent with our expectations.

NMHC+NO_X Standard

As we proposed, we are finalizing a 3.5 g/bhp-hr NMHC+NO_X standard for engines in the 25–50 hp range for 2013. We received limited comments arguing that the NMHC+NO_X standard should be less stringent. Like the PM standard, some commenters argued that the NO_X standard would be costly and complicated, although not necessarily infeasible to apply. Other commenters argued that the NO_X standard for engines in this category like the new standard for larger engines, should be based upon the application of advanced NO_X catalyst-based technologies. As described previously in section II.A, we do not believe that the catalyst-based NO_X technologies have matured to a state were we can accurately define a feasible technical path for compliance for engines in this power category. We intend to revisit this question in our

technology review and if we find that a viable technical path can be described we will consider the appropriateness of a more stringent catalyst-based standard.

The new standard aligns the NMHC+NO_X standard for engines in this power range with the Tier 3 standard for engines in the 50–75 hp range which are implemented in 2008. EPA's recent Staff Technical paper which reviewed the technological feasibility of the Tier 3 standards contains a detailed discussion of a number of technologies which are capable of achieving a 3.5 g/bhp-hr standard. These include cooled EGR, uncooled EGR, as well as advanced in-cylinder technologies relying on electronic fuel systems and turbocharging.[59] These technologies are capable of reducing NO_X emissions by as much as 50 percent. Given the Tier 2 NMHC+NO_X standard of 5.6 g/bhp-hr, a 50 percent reduction would allow a Tier 2 engine to comply with the 3.5 g/bhp-hr NMHC+NO_X standard set in this action. Therefore, we are projecting that 3.5 g/bhp-hr NO_X+NMHC standard is feasible with the addition of cooled EGR (the basis for our cost analysis) or other equally effective in-cylinder NO_X control technology as described in the RIA and our recent Staff Technical Paper. In addition, because this NMHC+NO_X standard is concurrent with the 0.02 g/bhp-hr PM standards which we project will be achievable with the use of particulate filters, engine designers will have significant additional flexibility in reducing NO_X because the PM filter will lessen the traditional concerns with the engine-out NO_X vs. PM trade-off.

Our recent highway 2004 standard review rulemaking (see 65 FR 59896, October 2000) demonstrated that a diesel engine with advanced electronic fuel injection technology as well as NO_X control technology such as cooled EGR is capable of complying with an NTE standard set at 1.25 times the laboratory-based FTP standard. We project that the same technology (electronic fuel systems and cooled EGR) are also capable for engine in the 25-75 hp range of complying with the NTE standard of 4.4 g/bhp-hr NMHC+NO_X (1.25 x 3.5) in 2013. This is based on the broad NO_X reduction capability of cooled EGR technology, which is capable of reducing NO_X emissions across the engine operating map (including the NTE region) by at least 30 percent even under high load conditions.[60]

Based on the information available to EPA and presented here, and giving appropriate consideration to the lead time necessary to apply the technology as well, we have concluded the

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[59] See section 2.2 through 2.3 in "Nonroad Diesel Emission Standards - Staff Technical Paper," EPA Publication EPA420-R-01-052, October 2001. Copy available in EPA Air Docket A-2001-28.

[60] See section 8 of "Control of Emissions of Air Pollution from 2004 and Later Model Year Heavy-Duty Highway Engines and Vehicles: Response to Comments," EPA document EPA420-R-00-011, July 2000, and chapter 3 of "Regulatory Impact Analysis: Control of Emissions of Air Pollution from Highway Heavy-duty Engines," EPA document EPA420-R-00-010, July 2000. Copies of both documents available in EPA docket A-2001-28.

0.02 g/bhp-hr PM standard for engines in the 25–75 hp category and the 3.5 g/bhp-hr NMHC+NO_X standards for the 25–50 hp engines are achievable.

5. Are the Standards for Engines under 25 hp Feasible?

As we explained at proposal and as discussed in section II.A, the new PM standard for engines less than 25 hp is 0.30 g/bhp-hr beginning in 2008. The certification test cycle for this standard is the ISO C1 cycle (or other appropriate steady-state test as defined by the engine's intended use) from 2008 through 2012. Beginning in 2013, the NRTC (with cold-start) and the NTE will also apply to engines in this category. As discussed below, we are not setting a new standard more stringent than the existing Tier 2 NMHC+NO_X standard for this power category at this time. This section describes what makes the less than 25 hp category different and why the standards are technologically feasible.

a. What makes the under 25 hp category unique?

As we explained at proposal and in the RIA, nonroad engines less than 25 hp are the least sophisticated nonroad diesel engines from a technological perspective. All of the engines currently sold in this power category lack electronic fuel systems and turbochargers. Nearly 20 percent of the products have two-cylinders or less, and 14 percent of the engines sold in this category are single-cylinder products, a number of these have no batteries and are crank-start machines, much like today's simple walk behind lawnmower engines. In addition, given what we know today and taking into account the Tier 2 standards which have not yet been implemented, we are not projecting any significant penetration of advanced engine technology, such as electronically controlled fuel systems, into this category in the next 5 to 10 years.

b. What data indicate that the standards are feasible?

We project the Tier 4 PM standard can be met by 2008 based on: the existence of a large number of engine families which meet the new standards today; the use of engine-out reduction techniques; and the use of diesel oxidation catalysts.

Engines in the less than 25 hp category must meet Tier 1 NMHC+NO_X and PM standards today. We have examined the 2004 model year engine certification data for nonroad diesel engines less than 25 hp. These data indicate that a number of engine families meet the new Tier 4 PM standard (and the 2008 NMHC+NO_X standard, unchanged from Tier 2) today. The data show that 31 percent of the engine families are at or below the PM standard today, while meeting the 2008 NMHC+NO_X standard. At the time of the proposal, we examined the model year 2002 certification, which indicated approximately 30 percent of the engine families were at or below the 2008 emission standards. This certification data includes both IDI and DI engines, as well as

a range of certification test cycles.[61] Many of the engine families are certified well below the Tier 4 standard while meeting the 2008 NMHC+NO_X level. Specifically, for the model year 2002 data, 15 percent of the engine families are cleaner than the new Tier 4 PM standard by more than 20 percent. The public certification data indicate that these engines do not use turbocharging, electronic fuel systems, exhaust gas recirculation, or aftertreatment technologies. We saw little change between the model year 2002 and 2004 data for this power category primarily because both model years are subject to the Tier 1 standards, and many engine families are simply carried over from the previous model year. Tier 2 standards for these engines will not be implemented until model year 2005. A detailed discussion of these data is contained in the RIA.

In summary then, there are two likely means by which companies can comply with the 2008 PM standard for engines under 25 hp. First, engine manufacturers can comply with this standard using known engine-out techniques (e.g., optimizing combustion chamber designs, fuel-injection strategies). In fact, some fraction of engines already would comply with the emission standard. In addition, some engine manufacturers may choose to use diesel oxidation catalysts to meet this standard. Our cost analysis makes the conservative assumption (i.e., the higher cost assumption) that all manufacturers will use DOCs to comply with these emission standards.

As discussed in section II.A, we are finalizing supplemental test procedures and standards (nonroad transient test cycle and not-to-exceed requirements) for engines in the under 25 hp category beginning in 2013. The supplemental test procedures and standards will apply not only to PM, but also to NMHC+NO_X. The engine technologies necessary to comply with the supplemental test procedures and standards are the same as the technology necessary to comply with the 2008 standard, and we have given consideration to these test conditions in setting this standard. The range of operating conditions covered by the various test cycles and the mechanism for emission control over those ranges of operation are substantially similar allowing us to conclude that emission control will be substantially uniform across these test procedures. However, we are delaying the implementation of the supplemental test procedures and standards until 2013, as proposed, in order to implement these supplemental requirements on the larger powered nonroad engines before the smallest power category. (There were no adverse comments on this aspect of the proposed rule.) This will also provide engine manufacturers with additional time to install any emission testing equipment upgrades they may need in order to implement the new nonroad transient test cycle.

Based on the existence of a number of engine families which already comply with the new Tier 4 PM standard (and the 2008 NMHC+NO_X standard), and the availability of PM reduction technologies such as improved mechanical fuel systems, combustion chamber

[61] The Tier 1 and Tier 2 standards for this power category must be demonstrated on one of a variety of different engine test cycles. The appropriate test cycle is selected by the engine manufacturer based on the intended in-use applications(s) of the engine.

improvements, and in particular diesel oxidation catalysts, we project that the 0.30 g/bhp-hr PM standards is technologically feasible by model year 2008.

6. Meeting the Crankcase Emissions Requirements

The most common way to eliminate crankcase emissions has been to vent the blow-by gases into the engine air intake system, so that the gases can be recombusted. Prior to the HD2007 rulemaking, we have required that crankcase emissions be controlled only on naturally aspirated diesel engines. We had made an exception for turbocharged diesel engines (both highway and nonroad) because of concerns in the past about fouling that could occur by routing the diesel particulates (including engine oil) into the turbocharger and aftercooler. However, this is an environmentally significant exception since most nonroad equipment over 75 hp use turbocharged engines, and a single engine can emit over 100 pounds of NO_X, NMHC, and PM from the crankcase over its lifetime.

Given the available means to control crankcase emissions, we eliminated this exception for highway engines in 2007 and similarly in today's action are eliminating the exception for nonroad diesel engines as well. A number of commenters supported this provision noting that the necessary technologies are already in application in Europe and will be required for heavy-duty diesel trucks in the United States beginning in 2007.

We anticipate that the diesel engine manufacturers will be able to control crankcase emissions through the use of closed crankcase filtration systems or by routing unfiltered blow-by gases directly into the exhaust system upstream of the emission control equipment. However, the provisions have been written such that if adequate control can be had without "closing" the crankcase then the crankcase can remain "open." Compliance would be ensured by adding the emissions from the crankcase ventilation system to the emissions from the engine control system downstream of any emission control equipment. We have limited this provision for controlling emissions from open crankcases to turbocharged engines, which is the same as for heavy-duty highway diesel engines.

Some commenters in essence argued that the Agency was obligated to show that all potential compliance paths were feasible and absent that showing that the Agency should reconsider this provision. Our feasibility analysis is based on the use of closed crankcase technologies designed to filter crankcase gases sending the clean gas to the engine intake for combustion and returning the oil filtered from the gases to the engine crankcase. These systems are proven in use and the use of this technology to eliminate crankcase emissions is acceptable to demonstrate compliance. The other options, the option to vent crankcase emissions into the exhaust or to continue to vent crankcase emissions to the atmosphere provided the total emissions including tailpipe and crankcase emissions do not exceed the standards are provided as alternate solutions that are clearly effective to control emissions (i.e., if the emissions are measured and are below the standard they are adequately controlled). The commenter suggests however, that they may not be able to control the emissions to the required level using these

alternate approaches. In this case, a manufacturer would need to use the primary approach identified by EPA, closing the crankcase and routing the filtered gases to the engine's intake (this is the approach we used in the cost analysis summarized in section VI). We have allowed the alternative approaches at the recommendation of some in industry, because if they prove to be effective we accept that resulting total emissions will be acceptably low.

C. Why Do We Need 15ppm Sulfur Diesel Fuel?

The new Tier 4 emission standards for most categories of nonroad diesel engines are predicated on the application of advanced diesel emission control technologies that are being developed for on-highway diesel engines to meet the HD2007 emission standards, namely catalyzed diesel particulate filters and NO_X adsorber catalysts. Sulfur in diesel fuel significantly impacts the durability, efficiency and cost of applying these technologies. Therefore, we required that on-highway diesel fuel produced for use in 2007 or newer on-highway diesel engines have sulfur content no higher than 15 ppm. Based on the same concerns outlined in the 2007 rulemaking, discussed in the proposal at 68 FR 28395-28400, set out in the RIA, and briefly summarized below, we today are finalizing a requirement that diesel fuel for nonroad engines be reduced to no higher than 15 ppm beginning in 2010. There was consensus among commenters that such standards were necessary if the proposed standards based on advanced diesel emission control technologies were to be achievable.

Sulfur in diesel fuel acts to poison the oxidation function of platinum-based catalysts including DOCs and CDPFs reducing the oxidation efficiency substantially, especially at lower temperatures. This poisoning limits the effectiveness of DOCs and CDPFs to oxidize CO and HC emissions. Of even greater concern is the reduction in NO oxidation efficiency of the CDPF due to sulfur poisoning. NO oxidation to NO_2 is a fundamental mechanism for PM filter regeneration necessary to ensure robust operation of the CDPF (i.e., to prevent filter plugging). Sulfur poisoning from sulfur in diesel fuel at levels higher than 15 ppm has been shown to increase the likelihood of PM filter failure due to a depressed NO to NO_2 oxidation efficiency of the CDPF. The RIA documents substantial field experience in Europe regarding this phenomenon.

Sulfur in diesel fuel can itself be oxidized to form sulfate PM emitted into the environment. CDPFs in particular are designed for robust regeneration and are highly effective at oxidizing sulfur to sulfate PM (approaching 100 percent conversion under some circumstances). The sulfate PM emissions from a CDPF when operated on 350 ppm fuel can be so high as to actually increase the PM emission rate above the baseline level for an engine without a PM filter. In spite of more than ten years of research, no effective means has been found to provide the NO to NO_2 oxidation efficiency needed to ensure robust filter regeneration without similarly increasing efficiency to oxidize sulfur to sulfate PM. Conversely, technologies developed to suppress sulfate PM formation (e.g., the addition of vanadium to DOCs designed to operate on 500 ppm sulfur fuel) also suppress NO to NO_2 formation. Therefore, it is not possible to apply the robust CDPF technology to achieve the PM standards without first having lower

diesel fuel sulfur levels. The RIA documents substantial test data showing the impact of sulfur in diesel fuel on total PM emissions due to an increase in sulfate PM emissions.

Sulfur from diesel fuel likewise poisons the storage function of the NO_X adsorber catalyst. Sulfur in the exhaust in the form of SO_X is stored on the catalyst in the same way as the NO_X emissions are stored. Unfortunately, due to the chemical properties of the materials, the sulfur is stored preferentially to the NO_X and will actually displace the stored NO_X emissions. The stored sulfur is not easily removed from the catalyst. A sulfur removal step, called a desulfation, can be accomplished by raising exhaust temperatures to a very high level while simultaneously increasing the reductant content of the exhaust above the stoichiometric level (i.e., more fuel than oxygen in the exhaust). This process can be effective to remove sulfur from the catalyst but at the expense of damaging the catalyst slightly. Over the lifetime of a diesel engine the cumulative damage from repeated desulfation events, as would be required if operation on higher than 15 ppm sulfur fuels were attempted, would lead to excessive damage and loss in NO_X control. The RIA contains an extensive description of this phenomena including the tradeoff between higher fuel sulfur levels and more frequent desulfation events.

The damage that sulfur inflicts on both the CDPF and NO_X adsorber technologies not only reduces their effectiveness but also impacts the fuel economy of their application. Reduced soot regeneration potential due to sulfur poisoning would lead to the need for more frequent active CDPF regeneration. As each active soot regeneration event consumes fuel, more frequent regeneration events with higher fuel sulfur levels leads to an increase in fuel consumption. Similarly, higher fuel sulfur levels would necessitate more frequent NO_X adsorber desulfation events and thus higher fuel consumption. An estimate of the impact of higher fuel sulfur levels on fuel economy due to more frequent desulfation events can be found in the RIA.

For all of the reasons documented in the RIA and summarized here, we remain convinced that a cap of 15 ppm fuel sulfur is necessary for both on-highway and nonroad diesel engines in order to apply the advanced emission control technologies necessary to meet the emission standards we are finalizing today.

III. Requirements for Engine and Equipment Manufacturers

This section describes the regulatory changes being made for the engine and equipment compliance program. A number of specific items are discussed in this section, including test procedures, certification fuels, and credit program provisions. These provisions are important in that they help us ensure the engines and equipment will meet the new requirements throughout their entire useful life, thus achieving the expected emission and public health benefits.

One of the most obvious changes from the Tier 2/Tier 3 program is that the regulations for Tier 4 engines have been written in a plain language format. They are structured to contain the provisions that are specific to nonroad compression ignition (CI) engines in a new part 1039, and to apply the general provisions of existing parts 1065 and 1068. The plain language regulations, however, are not intended to significantly change the compliance program, except as specifically noted in today's notice and supporting documents. These plain language regulations will only apply for Tier 4 engines. The changes from the existing nonroad program are described below along with other notable aspects of the compliance program.

As described below, we received comments from a broad range of commenters for some of these issues . For other issues, we received only manufacturer comments or no comments at all. See Chapter 9 of the Summary and Analysis of Comments for more information about the comments received and our responses to them.

A. Averaging, Banking, and Trading

1. Why are we adopting an ABT program for Tier 4 nonroad diesel engines?

EPA has included averaging, banking, and trading (ABT) programs in almost all of its recent mobile source emission control programs. Our existing regulations for nonroad diesel engines include an ABT program (40 CFR 89.201 through 89.212). With today’s action we are retaining the basic structure of the existing nonroad diesel ABT program, though we are adopting a number of changes to accommodate implementation of the newly adopted Tier 4 emission standards. The ABT program is intended to enhance the ability of engine manufacturers to meet the stringent standards adopted today. The program is also structured to limit production of very high-emitting engines and to avoid unnecessary delay of the transition to the new exhaust emission control technologies.

We view the ABT program as an important element in setting emission standards that are appropriate under CAA section 213(a) with regard to technological feasibility, lead time, and cost, given the wide breadth and variety of engines covered by the standards. As we noted at proposal, if there are engine families that will be particularly costly or have a particularly hard time coming into compliance with the standard, this flexibility allows the manufacturer to adjust the compliance schedule accordingly, without special delays or exceptions having to be written

into the rule. Emission-credit programs also create an incentive for the early introduction of new technology (for example, to generate credits in early years to create compliance flexibility for later engines), which allows certain engine families to act as trailblazers for new technology. This can help provide valuable information to manufacturers on the technology before they apply the technology throughout their product line. This early introduction of clean technology improves the feasibility of achieving the standards and can provide valuable information for use in other regulatory programs that may benefit from similar technologies. Early introduction of such engines also secures earlier emission benefits.

In an effort to make information on the ABT program more available to the public, we intend to issue an annual report summarizing use of the ABT program by engine manufacturers. The information contained in the reports will be based on the information submitted to us by engine manufacturers in their annual reports, and summarized in a way that protects the confidentiality of individual engine manufacturers. We believe this information will also be helpful to engine manufacturers by giving them a better indication of the availability of credits.

2. What are the provisions of the ABT program?

The following section describes the ABT provisions being adopted with today's action. Areas in which we have made changes to the proposed ABT program are highlighted. A complete summary of comments received on the proposed ABT program and our response to those comments are contained in the Summary and Analysis of Comments document for this rule.

The ABT program has three main components. Averaging means the exchange of emission credits between engine families within a given engine manufacturer's product line. Engine manufacturers divide their product line into "engine families" that are comprised of engines expected to have similar emission characteristics throughout their useful life. Averaging allows a manufacturer to certify one or more engine families at levels above the applicable emission standard, but below a set upper limit. However, the increased emissions must be offset by one or more engine families within that manufacturer's product line that are certified below the same emission standard, such that the average emissions from all the manufacturer's engine families, weighted by engine power, regulatory useful life, and production volume, are at or below the level of the emission standard. (The inclusion of engine power, useful life, and production volume in the averaging calculations is designed to reflect differences in the in-use emissions from the engines.) Averaging results are calculated for each specific model year. The mechanism by which this is accomplished is certification of the engine family to a "family emission limit" (FEL) set by the manufacturer, which may be above or below the standard. An FEL that is established above the standard may not exceed an upper limit specified in the ABT regulations. Once an engine family is certified to an FEL, that FEL becomes the enforceable emissions limit for all the engines in that family for purposes of compliance testing. Averaging is allowed only between engine families in the same averaging set, as defined in the regulations.

Banking means the retention of emission credits by the engine manufacturer for use in future model year averaging or trading. Trading means the exchange of emission credits between nonroad diesel engine manufacturers which can then be used for averaging purposes, banked for future use, or traded to another engine manufacturer.

The existing ABT program for nonroad diesel engines covers NMHC+NO_X emissions as well as PM emissions. With today's action and as proposed, we are making the ABT program available for the Tier 4 NO_X standards (and NMHC+NO_X standards, where applicable) and the Tier 4 PM standards. As proposed, ABT will not be available for the Tier 4 NMHC standards for engines above 75 horsepower.

Engine manufacturers commented that ABT will most likely be necessary for the Tier 4 CO standards, given the reductions in PM and NO_X emissions. In the Tier 4 proposal, we proposed minor changes in CO standards for some engines solely for the purpose of helping to consolidate power categories and improving administrative efficiency. However, as noted earlier in section II.A.6, we have withdrawn this aspect of the proposal. We do note, however, that we are applying new certification tests to all pollutants covered by the rule, the result being that Tier 4 engines will have to certify to CO standards measured by the transient test (including a cold start component), and the NTE. However, as shown in RIA chapter 4.1.1.2 (see e.g., note F), we believe that application of Tier 4 technologies will lead to a reduction in CO emissions over the Tier 3 baseline. We thus believe the CO standards will be readily achievable under the transient test and NTE. Moreover, we believe that there will not be any associated costs: the CO standards can be met without any further technological improvements (i.e., improvements other than those already necessary to meet the Tier 4 standards) and these tests will already be used for certification. Since CO standards measured by the new certification tests are achievable without cost, there is no basis for allowing ABT because no additional lead time is needed.

As noted earlier, the existing ABT program for nonroad diesel engines includes FEL caps -- limits on how high the emissions from credit-using engine families can be. No engine family may be certified above these FEL caps. These limits provide manufacturers with compliance flexibility while protecting against the introduction of unnecessarily high-emitting engines. In the past, we have generally set the FEL caps at the emission levels allowed by the previous standard, unless there was some specific reason to do otherwise. With today's action, we are taking a different approach because the level of the standards being adopted for most engines are significantly lower than the current level of the standards. The transfer to new technology is feasible and appropriate. Thus, as proposed, to ensure that the ABT provisions are not used to continue unnecessarily to produce old-technology high-emitting engines under the new program, the FEL caps are not, in general, set at the previous standards. Exceptions have been made for the NMHC+NO_X standard for engines between 25 and 50 horsepower effective in model year 2013 and the NO_X standards applicable to engines above 750 horsepower in 2011, where we are using the estimated NO_X-only equivalent for the previously applicable NMHC+NO_X standard for the FEL cap since the gap between the previous and newly adopted standards is approximately 40 percent (rather than 90 percent for engines between 75 and 750 horsepower), and because the

technology basis for these standards can be a form of engine-out control, like the previous tier standards. This approach of setting FEL caps at lower levels than the previously applicable standards is consistent with the level of the FEL limits set in the 2007 on-highway heavy-duty diesel engine program.

STAPPA/ALAPCO supported the proposed FEL caps. The Engine Manufacturers Association (EMA) commented that EPA should eliminate the FEL caps altogether. They believe FEL caps are unnecessary because the zero-sum requirement of ABT will ensure that there are no adverse emission impacts. Short of eliminating the FEL caps, they commented that EPA should set FEL caps at the level of the previous standards, not the more stringent levels proposed. With today's action, EPA is adopting the FEL caps as proposed, with some exceptions for engines above 750 horsepower (where we are adopting different standards than originally proposed) and for phase-in engines between 75 and 750 horsepower (where we have adopted an option for manufacturers to certify to alternative NO_X standards during the phase-in period). We continue to believe that it is important to ensure that technology turns over in a timely manner and that manufacturers do not continue producing large numbers of high-emitting, old technology engines once the Tier 4 standards become fully effective. (As noted below, however, we are adopting provisions that allow manufacturers to produce a limited number of 75 to 750 horsepower engines for a limited period that are certified with FELs as high as the previous tier of standards.) For the Tier 4 standards, where the standards are being reduced by an order of magnitude, we believe this goal to be particularly important, and in keeping with the technology-forcing provisions of section 213(a). It simply would not be appropriate to have long-term FEL caps that allowed engines to indefinitely have emissions as high as ten times the level of the standard.

For engines between 75 and 750 horsepower certified using the phase-in/phase-out approach, there will be two separate sets of engines with different FEL caps. For engines certified to the existing (Tier 3) NMHC+NO_X standards during the NO_X phase-in (referred to generally as "phase-out" engines), the FEL cap for these pollutants will (almost necessarily) be the existing FEL caps adopted in the October 1998 Tier 3 rule. For engines certified to the newly adopted Tier 4 NO_X standard during the phase-in (referred to generally as "phase-in" engines), we have revised the proposed FEL cap to be 0.60 g/bhp-hr, consistent with the proposed long-term Tier 4 NO_X FEL cap. As described in section II.A.2.c above, we have used the creation of alternative NO_X standards for engines between 75 and 750 horsepower to restate the phase-in/phase-out concept as a path truly focused on achieving high-efficiency NO_X aftertreatment during the phase-in years. Setting the NO_X FEL cap at 0.60 g/bhp-hr for phase-in engines will ensure this happens if a manufacturer chooses to certify to the phase-in provisions. In contrast, the higher FEL caps which we proposed (see 68 FR 28467–28468) would not have achieved this objective.

Beginning in model year 2014 when the Tier 4 NO_X standards for engines between 75 and 750 horsepower take full effect, we are adopting a NO_X FEL cap of 0.60 g/bhp-hr for all engines. We reiterate that given the fact that the Tier 4 NO_X standard is approximately a 90 percent

reduction from the existing standards for engines between 75 and 750 horsepower, we do not believe the previous standard is appropriate as the FEL cap for engines having to comply with the Tier 4 NO_X standard of 0.30 g/bhp-hr. We believe that the NO_X FEL caps will ensure that manufacturers adopt NO_X aftertreatment technology across all of their engine designs.

For the interim PM standards for engines between 25 and 75 horsepower effective in model year 2008 and for the Tier 4 PM standards for engines below 25 horsepower, we are adopting the previously applicable Tier 2 PM standards for the FEL caps (which do vary within the 25 to 75 horsepower category) because the gap between the previous standards and the newly adopted standards is approximately 50 percent (rather than in excess of 90 percent for engines between 75 and 750 horsepower), and the technology basis for the 2008 PM standards can be a form of engine-out control, like the previous tier standard. For the Tier 4 PM standard effective in model year 2013 for engines between 25 and 75 horsepower, we are adopting a PM FEL cap of 0.04 g/bhp-hr, and for the Tier 4 PM standard effective in model years 2011 and 2012 for engines between 75 and 750 horsepower, we are adopting a PM FEL cap of 0.03 g/bhp-hr. As with the Tier 4 NO_X standards for these engines, given the fact that these Tier 4 aftertreatment-based PM standards for engines between 25 and 750 horsepower are over 90 per cent more stringent than the previous standards, we do not believe the previous standards are appropriate as FEL caps once the Tier 4 standards take effect. We believe that the newly adopted PM FEL caps will ensure that manufacturers adopt PM aftertreatment technology across all of their engine designs (except for a limited number of engines), yet will still provide substantial flexibility in meeting the standards.

The final Tier 4 standards for engines above 750 horsepower have been revised from the proposal. We similarly revised a number of the proposed ABT provisions for engines above 750 horsepower. Beginning in 2011, all engines above 750 horsepower will be required to meet a NO_X standard of 2.6 g/bhp-hr, except for those above 1200 horsepower used in generator sets which will be required to meet a NO_X standard of 0.50 g/bhp-hr. The NO_X FEL cap for the 2011 standards will be 4.6 g/bhp-hr, which is an estimate of the NO_X emissions level that is expected under the combined NMHC+NO_X standards that apply with the previously applicable tier for engines above 750 horsepower. Beginning in 2011, all engines above 750 horsepower will have to meet a PM standard of 0.075 g/bhp-hr. The PM FEL cap for the 2011 PM standard will be the previously-applicable Tier 2 standard of 0.15 g/bhp-hr. As noted above, because the 2011 NO_X and PM standards are approximately 50 percent lower than the previous standard (rather than in excess of 90 percent for engines between 75 and 750 horsepower), and for most engines are based on performance of the same type of technology (engine-out), we are adopting the previously applicable Tier 2 standards for the FEL caps.

Beginning in model year 2015, the 0.50 g/bhp-hr NO_X standard will apply to all engines above 750 horsepower used in generator sets. Beginning in model year 2015, the PM standard drops to 0.02 g/bhp-hr for engines greater than 750 horsepower used in generator sets and 0.03 g/bhp-hr for engines greater than 750 horsepower used in other machines. Consistent with the Tier 4 FEL caps for lower horsepower categories where the new standards are significantly lower

than the previously applicable standards and reflect performance of aftertreatment technology, we are adopting a NO_X FEL cap of 0.80 g/bhp-hr for engines used in generator sets and PM FEL caps of 0.04 g/bhp-hr for engines used in generator sets and 0.05 g/bhp-hr for engines used in other machines (i.e., mobile machines). We believe that the FEL caps for engines above 750 horsepower will ensure that manufacturers adopt PM aftertreament technology across all of their engine designs and NO_X aftertreatment for generator sets once the 2015 standards are adopted, while allowing for some meaningful use of averaging beginning in 2015.

Table III.A-1 contains the FEL caps and the effective model year for the FEL caps (along with the associated standards adopted for Tier 4). It should be noted that for Tier 4, where we are adopting a new transient test for most engines, as well as retaining the current steady-state test, the FEL established by the engine manufacturer will be used as the enforceable limit for the purpose of compliance testing under both test cycles. In addition, under the NTE requirements, the FEL times the appropriate multiplier will be used as the enforceable limit for the purpose of such compliance testing. This is consistent with how FELs are used for compliance purposes in the 2007 on-highway heavy-duty diesel engine program.

Table III.A-1. – FEL Caps for the Tier 4 Standards in the ABT Program (g/bhp-hr)

Power Category	Effective Model Year	NO_X Standard	NO_X FEL Cap	PM Standard	PM FEL Cap
hp <25 (kW <19)	2008+	5.6[a]	7.8[a] for <11hp 7.1[a] for >11hp	0.30[c]	0.60
25 ≤ hp < 50 (19 ≤ kW < 37)	2008-2012	5.6[a]	7.1[a]	0.22	0.45
25 ≤ hp < 50 (19 ≤ kW < 37)	2013+	3.5[b]	5.6[b]	0.02	0.04[f]
50 ≤ hp < 75 (37 ≤ kW < 56)	2008-2012[d]	3.5[a]	5.6[a]	0.22	0.30
50 ≤ hp < 75 (37 ≤ kW < 56)	2013+[e]	3.5[a]	5.6[a]	0.02	0.04[f]
75 ≤ hp < 175 (56 ≤ kW <130)	2012+	0.30	0.60[f,g,h]	0.01	0.03[f]
175 ≤ hp ≤ 750 (130 ≤ kW ≤ 560)	2011+	0.30	0.60[f,g,h]	0.01	0.03[f]
hp > 750 (kW >560)	2011-2014	2.6	4.6	0.075	0.15
		0.50[i]	4.6		
Generator Sets hp > 750 (kW >560)	2015+	0.50	0.80[f]	0.02	0.04[f]
Other Machines hp >750 (kW >560)	2015+	2.6[j]	4.6[j]	0.03	0.05[f]

Notes:

[a] These are the previous tier NMHC+NO_X standards and FEL caps. These levels are not being revised with today's rule and are printed here solely for readers' convenience.

[b] These are a combined NMHC+NO_X standard and FEL cap.

[c] A manufacturer may delay implementation until 2010 and then comply with a PM standard of 0.45 g/bhp-hr for air-cooled, hand-startable, direct injection engines under 11 horsepower.

[d] These FEL caps do not apply if the manufacturer opts out of the 2008 standards. In such cases, the existing Tier 3 standards and FEL caps continue to apply.

[e] The FEL caps apply in model year 2012 if the manufacturer opts out of the 2008 standards.

[f] As described in this section, a small number of engines are allowed to exceed these FEL caps.

[g] For engines certified as phase-out engines, the NMHC+NO_X FEL caps for the Tier 3 standards apply.

[h] For engines certified to the alternative NO_X standards during the phase-in, the NO_X FEL caps shown in tables III.A-3 and III.A-4 apply.

[i] The 0.50 g/bhp-hr NO_X standard applies only to engines above 1200 horsepower used in generator sets.

[j] The 2011 NO_X standard and FEL cap continue to apply unless and until revised by EPA in a future action.

As noted above, we are allowing a limited number of engines to have a higher FEL than the caps noted in table III.A-1 in certain instances. The FEL cap for such engines would be set based on the level of the standards that applied in the year prior to the new standards and will allow manufacturers to produce a limited number of engines certified to these earlier standards in the Tier 4 timeframe. The allowance to certify up to these higher FEL caps will apply to Tier 4 engines between 25 and 750 horsepower beginning as early as the 2011 model year, and will apply to engines above 750 horsepower starting with the 2015 model year. The provisions are intended to provide some limited flexibility for engine manufacturers as they make the transition to the aftertreatment-based Tier 4 standards while ensuring that the vast majority of engines are converted to the advanced low-emission technologies expected under the Tier 4 program.

Under the proposal, manufacturers would have been allowed to certify at levels up to these FEL caps for ten percent of its engines in each of the first four years after the Tier 4 standards took effect and then five percent for subsequent years. The California Air Resources Board supported the proposed allowance. The Engine Manufacturers Association commented that the percentages of engines allowed to the higher FEL caps may not be sufficient, noting that it is too early to tell if the proposed amounts provided enough flexibility.

In an effort to provide flexibility to engine manufacturers while preserving the effective number of engines allowed to certify at levels up to the higher FEL caps, we are revising the proposed provisions with today's action. The revised provisions are intended to allow manufacturers to produce the same number of engines certified to the higher FEL caps as would have been allowed under the proposal, but provide added flexibility in how they distribute the allowances over the first four years of the transition to the new standards. This additional lead time appears appropriate, given the potential that a limited set of nonroad engines may face especially challenging compliance difficulties. Under the provisions adopted today and subject to the limitations explained below, a manufacturer would be allowed to certify up to 40 percent of its engines above the FEL caps shown in table III.A-1 over the first four years the aftertreatment-based Tier 4 standards take effect (calculated as a cumulative total of the percent of engines exceeding these FEL caps in each year over the four years), with a maximum of 20 percent allowed in any given year (provided the FELs for these engines do not exceed levels specified below). During this four year period, manufacturers would not be required to perform transient testing or NTE testing on these engines because we expect these engines would be carried over directly from the previous tier without any modification. (NTE testing would apply to engines above 750 horsepower because the previously applicable set of standards required NTE testing.) Similarly, for engines between 75 and 750 horsepower, manufacturers would not be required to have closed crankcase controls on these engines because we also expect that these engines would be carried over directly from the previous tier without any modification. (Engines between 25 and 75 horsepower, and engines above 750 horsepower, would be required to have closed crankcase controls because the previously applicable set of standards require closed crankcase controls.)

For the purpose of calculating the number of credits such engines would use, the manufacturer would include an adjustment to the FEL to be used in the credit calculation equation. The adjustment would be included by multiplying the steady-state FEL by a Temporary Compliance Adjustment Factor (TCAF) of 1.5 for PM and 1.1 for NO_X. (The NO_X TCAF would not apply to engines that are not subject to the transient testing requirements for NO_X as discussed in section III.F.) We are adopting TCAFs in part to assure in-use control of emission from these engines in the absence of transient and NTE testing, and also to assure that any credits these engines use reflect the level of reductions expected in use. The level of the TCAFs are based on data from pre-control, Tier 1, and Tier 2 engines which show that the emissions from such engines tested over transient test cycles which are more representative of real in-use operation are higher than emissions from those engines tested over the steady-state certification test cycle. This is a sales weighted version of the Transient Adjustment Factor used in the NONROAD model. For compliance purposes, a manufacturer would be held accountable to the unadjusted steady-state FEL established for the engine family.

As proposed, after the fourth year the Tier 4 standards apply, the allowance to certify engines using the higher FEL caps shown in table III.A-2 will still be available but for no more than five percent of the engines a manufacturer produces in each power category in a given year. When the 5 percent allowance takes effect, these engines will be considered Tier 4 engines and all other requirements for Tier 4 engines will also apply, including the Tier 4 NMHC standard, transient testing, NTE testing, and closed crankcase controls. TCAFs thus do not apply when calculating the number of credits such engines would use.

In the two power categories where we are adopting phase-in provisions (i.e., 75 to 175 horsepower engines and 175 to 750 horsepower engines), the allowance to use a higher FEL cap will only apply to PM from phase-out engines during the phase-in years. We originally proposed that the allowance to use a higher FEL cap would apply to PM from either phase-in or phase-out engines during the phase-in years. On reflection, this is inconsistent with our policy that phase-in engines truly have low emissions reflecting use of aftertreatment (see also the discussion above where we explain that, for the same reason, we are adopting a NO_X FEL cap of 0.60 g/bhp-hr for phase-in engines). We consequently are revising the proposed allowance so that it is available for PM emissions only from phase-out engines. As proposed, the allowance to use a higher FEL cap for NO_X will apply starting in 2014 when the phase-in period is complete.

For the power category between 25 and 75 horsepower, this allowance to certify engines at levels up to the higher FEL caps will apply beginning with the Tier 4 standards taking effect in the 2013 model year and will apply to PM only. For manufacturers choosing to opt out of the 2008 model year Tier 4 standards for engines between 50 and 75 horsepower and instead comply with the Tier 4 standards beginning in 2012, the 40% allowance would apply to model years 2012 through 2015, and the 5% allowance would apply to model year 2016 and thereafter. The allowance to use the higher FEL caps is not applicable for the 2008 standards or the 2013 NMHC+NO_X standards for these engines because the FEL caps for those standards already are set at the level of the standard which previously applied.

For engines above 750 horsepower, the allowance to certify a limited number of engines at levels up to the higher FEL caps would apply beginning in model year 2015. (As noted, this is because the FEL caps being adopted for the 2011 standards for engines above 750 horsepower are the previous tier PM standard and the NO_X-only equivalent of the previous tier standard.) For NO_X, the allowance to certify a limited number of engines above the FEL cap beginning in model year 2015 will apply only to engines used in generator sets. Engines used in other machines are still subject to the model year 2011 NO_X standard and FEL caps. For PM, the allowance to certify a limited number of engines above the FEL caps beginning in model year 2015 will apply to all engines above 750 horsepower.

Table III.A-2 presents the model years, percent of engines, and higher FEL caps that will apply under these allowances. As noted above, engines certified under these higher FEL caps during the first four years would not be required to perform transient testing or NTE testing and engines between 75 and 750 horsepower would not be required to have closed crankcase controls on these engines. However, as also noted earlier, beginning in the fifth year, when the 5 percent allowance takes effect, these engines will be considered Tier 4 engines and all other requirements for Tier 4 engines will also apply, including the Tier 4 NMHC standard, transient testing, NTE testing, and closed crankcase controls.

Table III.A-2. – Allowance for Limited Use of an FEL Cap Higher than the Tier 4 FEL Caps

Power Category	Model Years	Engines Allowed to have Higher FELs	NO_X FEL Cap (g/bhp-hr)	PM FEL Cap (g/bhp-hr)
25 ≤ hp < 75 (19 ≤ kW < 56)	2013-2016[a]	40%[b]	Not applicable	0.22
	2017+[a]	5%		
75 ≤ hp < 175 (56 ≤ kW <130)	2012-2015	40%[b]	3.3[c] for hp <100 2.8[c] for hp ≥100	0.30[d] for hp <100 0.22[d] for hp ≥100
	2016+	5%		
175 ≤ hp ≤ 750 (130 ≤ kW ≤ 560)	2011-2014	40%[b]	2.8[c]	0.15[d]
	2015+	5%		
>750 hp (>560 kW)	2015-2018	40%[b,e]	2.6	0.075
	2019+	5%[e]		

Notes:

[a] For manufacturers choosing to opt out of the 2008 model year Tier 4 standards for engines between 50 and 75 horsepower and instead comply with the Tier 4 standards beginning in 2012, the 40% allowance would apply to model years 2012 through 2015, and the 5% allowance would apply to model year 2016 and thereafter.

[b] Compliance with the 40% limit is determined by adding the percent of engines that have FELs above the FEL caps shown in table III.A.-1 in each of the four years. A manufacturer may not have more than 20% of its engines exceed the FEL caps shown in table III.A-1 in any model year in any power category.

[c] The allowance to certify to these higher NO_X FEL caps is not applicable during the phase-in period.

[d] These higher PM FEL caps are applicable to phase-out engines only during the phase-in period.

[e] The limits of 40% or 5% allowed to exceed the NO_X FEL cap would apply to engines used in generator sets only. (Engines >750 hp used in other machines are allowed to have an NO_X FEL as high as 4.6 g/bhp-hr.) The limits of 40% or 5% allowed to exceed the PM FEL cap would apply to all engines above 750 hp.

Under the Tier 4 program, there will be two different groups of 75-750 horsepower engines during the NO_X phase-in period. In one group ("phase-out engines"), engines will certify to the applicable Tier 3 NMHC+NO_X standard and will be subject to the NMHC+NO_X ABT restrictions and allowances previously established for Tier 3. In the other group ("phase-in engines"), engines will certify to the 0.30 g/bhp-hr NO_X standard, and will be subject to the restrictions and allowances in this program. Although engines in each group are certified to different standards, we are (as proposed) allowing manufacturers to transfer credits across these two groups of engines with the following adjustment to the amount of credits generated.

Manufacturers will be able to use credits generated during the phase-out of engines subject to the Tier 3 NMHC+NO_X standard to average with engines subject to the 0.30 g/bhp-hr NO_X standard, but these credits will be subject to a 20 percent discount, the adjustment reflecting the NMHC contribution. Thus, each gram of NMHC+NO_X credits from the phase-out engines will be worth 0.8 grams of NO_X credits in the new ABT program. The ability to average credits between the two groups of engines will give manufacturers a greater opportunity to gain experience with the low-NO_X technologies before they are required to meet the final Tier 4 standards across their full production. The 20 percent discount will also apply, for the same reason, to all NMHC+NO_X credits used for averaging purposes with the NO_X standards for engines greater than 75 horsepower.

The California Air Resources Board supported the proposed discount of 20 percent on NMHC+NO_X credits used for NO_X compliance. The Engine Manufacturer's Association commented that we should eliminate the 20 percent "discount" on NMHC+NO_X credits used for NO_X compliance.

We disagree with the Engine Manufacturer's Association comments. As noted in the proposal, we have two main reasons for adopting this adjustment. First, the discounting addresses the fact that NMHC reductions can provide substantial NMHC+NO_X credits, which are then treated as though they were NO_X credits. For example, a 2010 model year 175 horsepower engine emitting at 2.7 g/bhp-hr NO_X and 0.3 g/bhp-hr NMHC meets the 3.0 g/bhp-hr NMHC+NO_X standard in that year, but gains no credits. In 2011, that engine, equipped with a PM trap to meet the new PM standard, will have very low NMHC emissions because of the trap, an emission reduction already accounted for in our assessment of the air quality benefit of this program. As a result, without substantially redesigning the engine to reduce NO_X or NMHC, the manufacturer could garner nearly 0.3 g/bhp-hr of NMHC+NO_X credit for each of these engines produced. Allowing these NMHC-derived credits to be used undiscounted to offset NO_X emissions on the phase-in engines in 2011 (for which each 0.1 g/bhp-hr of margin can make a huge difference in facilitating the design of engines to meet the 0.30 g/bhp-hr NO_X standard) would be inappropriate. Therefore, while we are reducing the value of credits earned from Tier 2/Tier 3 engines, the adjustment accounts for the NMHC fraction of the credits which we do not believe should be used to demonstrate compliance with the NO_X-only Tier 4 standards (such credits would be "windfalls" because they would necessarily occur by virtue of the technology needed to meet the PM standard) (68 FR 28469, May 23, 2003). Second, the discounting will work toward providing a small net environmental benefit from the ABT program, such that the more manufacturers use banked and averaged credits, the greater the potential emission reductions overall. Most basically, it is inherently reasonable, in using NO_X + NMHC reductions to show credit with a NO_X-only standard, to use only that portion which represents NO_X reductions. (Indeed, for this reason, terming the 20 per cent a 'discount factor' is a misnomer; it apportions the NMHC fraction of the reduction.) As noted, this is further supported by the fact that the NMHC reductions for phase-out engines are not extra reductions above and beyond what would otherwise occur, and therefore don't warrant eligibility as credits.

We are adopting one additional restriction on the use of credits under the ABT program. For the Tier 4 standards, we proposed that manufacturers could only use credits generated from other Tier 4 engines or from engines certified to the previously applicable tier of standards (i.e., Tier 2 for engines below 50 horsepower, Tier 3 for engines between 50 and 750 horsepower, and Tier 2 engines above 750 horsepower). This proposed restriction was similar to a restriction we currently have that prohibits the use of Tier 1 credits to demonstrate Tier 3 compliance. STAPPA/ALAPCO and the Natural Resources Defense Council supported the proposed approach that limited the use of previous-tier credits for Tier 4. The Engine Manufacturer's Association commented that by limiting the use of previous-tier credits, we are engaged in an unconstitutional taking because EPA had guaranteed in the previous Tier 2/Tier 3 rulemaking that such credits would not expire. We disagree that adopting a restriction on the use of the previous tier ABT credits is an unconstitutional taking. EPA did not, and could not, decide in the Tier 2/3 rulemaking that Tier 2/3 credits could be used to show compliance with some future standards that had not yet even been adopted. Thus, EPA in this rulemaking is not taking away something previously given. We are not revisiting the Tier 2/3 standards but establishing a new set of engine standards. In doing so, we necessarily must evaluate the provisions of previous rules and their potential impact on the future standards being considered. We are reasonably concerned that credits from engines certified to relatively high standards could be used to significantly delay the implementation of the final Tier 4 program and its benefits, resulting in a situation where the standards would no longer reflect the greatest degree of emission reduction available as required under section 213(a)(3) of the Clean Air Act, or would no longer be appropriate under section 213(a)(4) of the Clean Air Act. Therefore, with today's action, we are adopting the proposed provisions regarding the use of credits from previous tier engines, with one minor revision.

Under today's action, manufacturers may only use credits generated from other Tier 4 engines or from engines certified to the previously applicable tier of standards - except for engines between 50 and 75 horsepower. Because we are adopting Tier 4 standards that take effect as early as 2008 for those engines, the same year the previously-adopted Tier 3 standards are scheduled to take effect (see section II.A.1.a above), there is no possibility to earn credits against the Tier 3 standards for manufacturers that certify with the pull-ahead standards in 2008 for engines between 50 and 75 horsepower. Therefore, we will allow manufacturers to use credits from engines in the Tier 2 power category that includes 50 to 75 horsepower (i.e., the 50 to 100 horsepower category) that are certified to the Tier 2 standards if they choose to demonstrate compliance with the pull-ahead Tier 4 standards in 2008 for engines between 50 and 75 horsepower. Manufacturers that do not choose to comply with the 2008 Tier 4 standards for engines between 50 and 75 horsepower and instead comply with the 2012 Tier 4 standards for such engines will not be allowed to use Tier 2 credits in Tier 4, but instead will be allowed to use Tier 3 credits as allowed under the standard provisions regarding use of previous-tier credits only for Tier 4 compliance demonstration.

With regard to other restrictions on the use of ABT credits, we are adopting one restriction on the use of credits across the 750 horsepower threshold. In previous rulemakings,

EPA has defined "averaging sets" within which manufacturers may use credits under the ABT program. Credits may not be used outside of the averaging set in which they were generated. As described in section II.A.4 of today's action, we have revised the Tier 4 standards for engines above 750 horsepower. Because the standards for Tier 4 engines greater than 750 horsepower will not be based on the use of PM aftertreatment technology in 2011 or NO_X aftertreatment technology for all mobile machinery engines in 2015, we are adopting provisions that prevent manufacturers from using credits from model year 2011 and later model year engines greater than 750 horsepower to demonstrate compliance with engines below 750 horsepower. Without such a limit, we are concerned that manufacturers could use credits from such engines to significantly delay compliance with the numerically lower standards for engines below 750 horsepower. In addition, without such a limit, we are concerned that manufacturers could use credits from engines below 750 horsepower to delay implementation of aftertreatment technology for engines above 750 horsepower.

One engine manufacturer commented that EPA should include a barrier to trading credits across the 75 horsepower level. They cited concerns over the ability of manufacturers that produce a large range of engine sizes to use credits from high horsepower engines to offset emissions from their small horsepower engines. We are not adopting any averaging set restrictions for Tier 4 engines below 750 horsepower in today's action. In the current nonroad diesel ABT program, there are averaging set restrictions. The current averaging sets consist of engines less than 25 horsepower and engines greater than or equal to 25 horsepower. We adopted this restriction because of concerns over the ability of manufacturers to generate significant credits from the existing engines and use the credits to delay compliance with the newly adopted standards (63 FR 56977, October 23, 1998). We believe the Tier 4 standards for engines below 750 horsepower are sufficiently rigorous to limit the ability of manufacturers to generate significant credits from their engines. In addition, we believe the FEL caps being adopted today provide sufficient assurance that low-emissions technologies will be introduced in a timely manner. Therefore, we believe averaging can be allowed between all engine power categories below 750 horsepower without restriction effective with the Tier 4 standards. (It should be noted that the averaging set restriction placed on credits generated from Tier 2 and Tier 3 engines will continue to apply if they are used to demonstrate compliance for Tier 4 engines.)

EPA also proposed to allow engine manufacturers to demonstrate compliance with the NO_X phase-in requirements by certifying evenly split engine families at, or below, specified NO_X FELs (68 FR 28470, May 23, 2003). As described in section II.A.2.c above, EPA is revising the evenly split family provisions for the Tier 4 program and is now codifying them as alternative standards. (As described in section III.L, we also are adopting the proposed provisions allowing manufacturers to certify "split" engine families during the phase-in years.) Because the evenly split family provision has evolved into a set of alternative NO_X standards, we believe it is appropriate to allow manufacturers to use ABT for them. Table III.A-3 presents the FEL caps that will apply to engines certified to the alternative NO_X standards during the phase-in years. The FEL caps for these alternative standards have been set at levels reasonably close to the alternative standards and are intended to ensure sizeable emission reductions from the

previously-applicable Tier 3 standards. (For engines between 75 and 175 horsepower certified under the reduced phase-in option, the FEL cap is the NO_X-only equivalent of the previously applicable NMHC+NO_X standards because the alternative standard is sufficiently close to the Tier 3 standard.)

Table III.A-3. – NO_X FEL Caps for Engines Certified to the Alternative NO_X Standards

Power Category	Alternative NO_X Standard (g/bhp-hr)	NO_X FEL Cap (g/bhp-hr)
50/50/100 phase-in option for 75 ≤ hp < 175 (56 ≤ kW <130)	1.7	2.2
25/25/25/100 phase-in option for 75 ≤ hp < 175 (56 ≤ kW <130)	2.5	3.3 (for 75-100 hp) 2.8 (for 100-175 hp)
175 ≤ hp ≤ 750 (130 ≤ kW ≤ 560)	1.5	2.0

Because we are allowing manufacturers to use ABT for demonstrating compliance with the alternative standards for engines between 75 and 750 horsepower, we are allowing manufacturers to exceed the FEL caps noted in table III.A-3 and include them in the count of engines allowed to exceed the FEL caps (i.e., the 40 percent over the first four years the Tier 4 standards take effect as described earlier). Table III.A-4 presents the NO_X FEL caps that would apply to engines certified under the alternative standards (limited by the 40 percent cap over the first four years). The higher NO_X FEL caps are set at the estimated NO_X-only equivalent of the previous-tier NMHC+NO_X standards. For manufacturers certifying under the reduced phase-in (25 percent) option, because the FEL caps are the NO_X-only equivalent of the Tier 3 NMHC+NO_X standards, they may not exceed the FEL cap during the years the alternative standard applies.

Table III.A-4. – Limited-Use NO_X FEL Caps Under the Alternative NO_X Standards

Power Category	Model Years	NO_X FEL Cap (g/bhp-hr)
50/50/100 phase-in option for 75 ≤ hp < 175[a] (56 ≤ kW <130)	2012-2013	3.3 for hp <100 2.8 for hp ≥100

175 ≤ hp ≤ 750 (130 ≤ kW ≤ 560)	2011-2013	2.8

For reasons explained in section II.A.1.b.i above, we are also adopting unique phase-in requirements for NO_X standards for engines between 75 and 175 horsepower in order to ensure appropriate lead time for these engines. Because of these unique phase-in provisions, as proposed, we are adopting slightly different provisions regarding 75 to 175 horsepower engines' use of previous-tier credits. Under today's action, manufacturers that choose to demonstrate compliance with these phase-in requirements (i.e., 50 percent in 2012 and 2013 and 100 percent in 2014) or the 1.7 g/bhp-hr alternative NO_X standard (which is based on the 50 percent phase-in option) will be allowed to use Tier 2 NMHC+NO_X credits generated by engines between 50 and 750 horsepower (even though they are not generated by previous-tier engines), along with any other allowable credits, to demonstrate compliance with the Tier 4 NO_X standards for engines between 75 and 175 horsepower during model years 2012, 2013 and 2014 (the years of the phase-in) only. These Tier 2 credits will be subject to the power rating conversion already established in our ABT program, and to the 20% credit adjustment being adopted today for use of NMHC+NO_X credits as NO_X credits.

The requirements for manufacturers that choose to demonstrate compliance with the optional reduced phase-in requirement for engines between 75 and 175 horsepower (i.e, the 25/25/25 percent phase-in option; see Table II.A.-2, note b) or the 2.5 g/bhp-hr alternative NO_X standard (which is based on the 25 percent phase-in option) are different. Under the reduced phase-in requirement, use of credits will be allowed in accordance with the general ABT program provisions. In other words, manufacturers will not have the special allowance to use Tier 2 NMHC+NO_X credits generated by engines between 50 and 750 horsepower noted above to demonstrate compliance with the Tier 4 standards. In addition, manufacturers choosing the reduced phase-in option will not be allowed to generate NO_X credits from engines in this power category in 2012, 2013, and most of 2014, except for use in averaging within this power category (i.e., no banking or trading, or averaging with engines in other power categories will be permitted). This restriction will apply throughout this period even if the reduced phase-in option is exercised during only a portion of this period. We believe that this restriction is important to avoid potential abuse of the added flexibility allowance, considering that larger engine categories will be required to demonstrate substantially greater compliance levels with the 0.30 g/bhp-hr NO_X standard several years earlier than engines built under the reduced phase-in option.

As described in section II.A.3.a of today's action, and as proposed, we are adopting an optional PM standard for air-cooled, hand-startable, direct injection engines under 11 horsepower effective in 2010. In order to avoid potential abuse of this standard, engines certified under this requirement will not be allowed to generate any credits as part of the ABT program. Credit use by these engines will be allowed. The restriction on generating credits should not be a burden to manufacturers, as it will apply only to those air-cooled, hand-startable, direct injection engines under 11 horsepower that are certified under the optional approach, and the production of credit-

generating engines would be contrary to the standard's purpose. No adverse comments were submitted to EPA on this issue.

The current ABT program contains a restriction on trading credits generated from indirect injection engines greater than 25 horsepower. The restriction was originally adopted because of concerns over the ability of manufacturers to generate significant credits from existing technology engines (63 FR 56977, October 23, 1998). With today's action, there will be no restriction prohibiting manufacturers from trading credits generated on Tier 4 indirect fuel injection engines greater than 25 horsepower. Based on the certification levels of indirect injection engines, we do not believe there is the potential for manufacturers to generate significant credits from their currently certified engines against the Tier 4 standards. Therefore, as proposed, we are not adopting any restrictions on the trading of credits generated on Tier 4 indirect injection engines to other manufacturers. The restriction placed on the trading of credits generated from Tier 2 and Tier 3 indirect injection engines will continue to apply in the Tier 4 timeframe. No adverse comments were submitted to EPA on this issue.

As explained in the proposal, we are not applying a specific discount to Tier 3 PM credits used to demonstrate compliance with the Tier 4 standards (68 FR 28471, May 23, 2003). PM credits generated under the Tier 3 standards are based on testing performed over a steady-state test cycle. Under the Tier 4 standards, the test cycle is being supplemented with a transient test (see section III.F.1 below). Because in-use PM emissions from Tier 3 engines will vary depending on the type of application in which the engine is used (most applications having higher in-use PM emissions, some having lower in-use PM emissions), the relative "value" of the Tier 3 PM credits in the Tier 4 timeframe will differ. Instead of requiring manufacturers to gather information to estimate the level of in-use PM emissions compared to the PM level of the steady-state test, we believe allowing manufacturers to bring Tier 3 PM credits directly into the Tier 4 time frame without any adjustment is appropriate because it discounts their value for use in the Tier 4 timeframe (since the initial baseline being reduced is higher than measured in the Tier 2 test procedure for most applications). No adverse comments were submitted to EPA on this issue.

3. Are We Expanding the Nonroad ABT Program to Include Credits from Retrofit of Nonroad Engines?

In the proposal, we requested comment on expanding the scope of the standards by setting voluntary new engine emission standards applicable to the retrofit of nonroad diesel engines (68 FR 28471, May 23, 2003). As described in the proposal, retrofit nonroad engines would be able to generate PM and NO_X credits which would be available for use by new nonroad engines in the certification ABT program. We received a significant number of comments on a retrofit ABT program. A number of commenters associated with the agricultural sector were concerned retrofits would be mandatory. Some commenters were opposed to a retrofit credit program that would allow use of the credits under the certification ABT program. However, a number of commenters supported the concept of a retrofit program, but noted a number of

concerns regarding the details of such a program, including making sure that any credits earned would be verifiable and enforceable. Some commenters suggested that EPA consider the establishment of a retrofit credit program through a separate rulemaking because there were many details of the program that needed to be explored more fully before adopting such a program. In response to the comments, we are not adopting a retrofit credit program with today's action. Although we provided a detailed explanation of a potential program at proposal,[62] we believe it is important to more fully consider the details of a nonroad engine retrofit credit program and work with interested parties in determining whether a viable program can be developed. EPA intends to explore the possibility of a voluntary, opt-in nonroad retrofit credit program through a separate action later this year. Such a program would be based on the generation of credits beyond the scope of any existing retrofit program. The final rule contains no requirements for retrofitting existing engines or equipment.

B. Transition Provisions for Equipment Manufacturers

1. Why are we adopting transition provisions for equipment manufacturers?

As EPA developed the 1998 Tier 2/3 standards for nonroad diesel engines, we determined, as an aspect of determining an appropriate lead time for application of the requisite technology (pursuant to section 213 (b) of the Act), that provisions were needed to avoid unnecessary hardship and to create additional flexibility for equipment manufacturers. The specific concern is the amount of work required and the resulting time needed for equipment manufacturers to incorporate all of the necessary equipment redesigns into their applications in order to accommodate engines that meet the new emission standards. We therefore adopted a set of provisions for equipment manufacturers to provide them with reasonable lead time for the transition process to the newly adopted standards. The program consisted of four major elements: (1) a percent-of-production allowance, (2) a small-volume allowance, (3) availability of hardship relief, and (4) continuance of the allowance to use up existing inventories of engines (63 FR 56977-56978, October 23, 1998 and 68 FR 28472-28476, May 23, 2003).

Given the levels of the newly adopted Tier 4 standards, we believe that there will be engine design and other changes at least comparable in magnitude to those involved during the transition to Tier 2/3. Therefore, with a few exceptions described in more detail below, we are adopting transition provisions for Tier 4 that are similar to those adopted with the previous Tier 2/3 rulemaking. We also note that opportunities for greater flexibility arises from the structure of the Tier 4 rule. For example, Tier 4 consolidates the nine power categories in Tier2/3 into five categories, providing opportunities for more flexibility by allowing more engine families within each power category, with consequent increased averaging possibilities. The NO_X phase-in also provides increased flexibility opportunities, as do the longer Tier 4 lead times.

[62] See memorandum referenced at 68 FR 28471 (May 23, 2003), footnote 299.

We are adding new notification, reporting, and labeling requirements to the Tier 4 program. We believe these additional provisions are necessary for EPA to gain a better understanding of the extent to which these provisions will be used and to ensure compliance with the Tier 4 transition provisions. We are also adopting new provisions dealing specifically with foreign equipment manufacturers and the special concerns raised by the use of the transition provisions for equipment imported into the U.S. The following section describes the Tier 4 transition provisions available to equipment manufacturers. (Section III.C of this preamble describes all of the provisions that will be available specifically for small businesses.)

As under the existing Tier2/Tier 3 provisions, equipment manufacturers are not obligated to use any of these provisions, but all equipment manufacturers are eligible to do so. Also, as under the existing program, all entities under the control of a common entity, and that meet the regulatory definition of a nonroad vehicle or nonroad equipment manufacturer, must be considered together for the purpose of applying exemption allowances. This will not only provide certain benefits for the purpose of pooling exemptions, but will also preclude the abuse of the small-volume allowances that would exist if companies could treat each operating unit as a separate equipment manufacturer.

2. What transition provisions are we adopting for equipment manufacturers?

The following section describes the transition provisions being adopted with today's action. Areas in which we have made changes to the proposed transition program are highlighted. A complete summary of comments received on the proposed transition program and our response to those comments are contained in the Summary and Analysis of Comments document for this rule.

EPA believes that the lead time provided through the equipment maker transition flexibilities, as adopted in this rule, will be sufficient, as has proved the case in past tiers. These flexibilities provide equipment manufacturers with the selective ability to delay use of the Tier 4 engines in those applications where additional time is needed to successfully incorporate the redesigned engines into their equipment.

Ingersoll-Rand, an equipment manufacturer, submitted a number of comments arguing that significant expansions of the proposed flexibility program are needed if equipment manufacturers are to produce compliant applications within the effective dates of the standards. One suggestion was for EPA to include provisions that provide a definitive period of lead time for incorporation of Tier 4 engines into nonroad equipment. Ingersoll-Rand would have the rules specify a "made available" date before which each engine supplier must provide technical and performance specifications, complete drawings, and a final compliant engine to EPA and the open market. After the mandated "made available" date, equipment manufacturers should be provided a minimum 18 months of lead time to incorporate the new engines into nonroad equipment. One form of the suggestion also entailed a prohibition on design changes once the engine, specifications, drawings, etc. had been initially provided to EPA and to the open market.

As an alternative, Ingersoll-Rand urged that the percent of production allowance flexibility be expanded to 150 percent for the power categories between 75 and 750 horsepower and 120 percent for the power category between 25 and 75 horsepower. Ingersoll-Rand believes these levels correspond proportionately to the increased challenges facing equipment manufacturers during Tier 4 as opposed to Tier 2 and Tier 3.

As discussed in greater detail in the Summary and Analysis of Comments, as well as in later parts of this section of this preamble and elsewhere in the administrative record, we disagree with most of Ingersoll-Rand's suggestions. Our fundamental disagreement is with Ingersoll-Rand's premise that Tier 4 will create a situation where need for expanded equipment maker lead time is the norm rather than the exception so that the rule must provide a drastic, across-the-board expansion of equipment manufacturer lead time. We believe that the lead time provided for equipment makers in this rule is adequate, and that the equipment maker flexibilities we are adopting provide a reasonable and targeted safety valve to deal with isolated problems. There is no across-the-board problem necessitating a drastic expansion of equipment manufacturer lead time, or a drastic expansion of equipment manufacturer flexibilities. We base these conclusions largely on three factors: a) our investigation and understanding of the engineering process by which engine makers and equipment manufacturers bring new products to market; b) the specific engineering challenges which equipment manufacturers will address in complying with the Tier 4 rule; and c) past practice of equipment manufacturers under previous rules providing transition flexibilities for nonroad equipment.

Because it is in both parties' interest for new engines and new equipment applications to reach the market expeditiously, engine makers and equipment manufacturers usually adopt concurrent engineering programs whereby the new equipment design process occurs simultaneous to the new engine development process. We believe that this concurrent process should work well for Tier 4 because, in many important ways, the engineering challenges facing equipment manufacturers can be anticipated and dealt with early in the design process. We expect that relatively early in the design process, engine manufacturers will be able to define the size and characteristics of the emission control technologies (e.g., NO_X adsorbers and CDPFs), based on the same systems that will be in production for on-highway engines. The equipment manufacturers will concurrently redesign their equipment to accommodate these new technologies, including designing, mounting and supporting the catalytic equipment similar to current exhaust muffler systems.

Moreover, while we expect the redesign challenge for Tier 4 equipment to be similar to that for Tier 2/3, we also expect the redesign to be better and more clearly defined well in advance of the Tier 4 introduction dates. This is because we do not expect the catalyst system size or shape to change significantly during the last 24 months of the engine design and validation process.[63]

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[63] "Tier 4 Nonroad Diesel Equipment Flexibility Provisions," memorandum from Byron Bunker, et. al., (EPA) to EPA Air Docket OAR-2003-0012.

We also have studied the extent to which equipment manufacturers have used their flexibilities under the Tier 2/3 program. Although at an early stage in the Tier 2/3 process, initial indications are that the flexibility program is being used by many equipment manufacturers, but in general, manufacturers do not appear to be using the full level of allowances.[64] It appears that the flexibilities are being used as EPA intended, providing manufacturers with flexibility to deal with specific limited situations, rather than to deal with an across-the-board problem.

The emerging pattern is thus the one on which the flexibility program is predicated: there is not a need for across-the-board drastic expansion of equipment manufacturer lead time. Indeed, such an expansion would be inconsistent with the lead time-forcing nature of section 213 (b) of the Act. This is not to say that there is no need for equipment manufacturer flexibilities, or that the Tier 2/3 flexibility format need not be adjusted to accommodate potential problems to be faced under the Tier 4 regime. Instances where additional lead time could be justified are where resource constraints prevent completion of certain applications, or where for business reasons it makes sense for equipment manufacturers to delay completion of small volume families in order to complete larger volume equipment applications. In addition, the Tier 2/3 experience illustrates that there can be instances where emission control optimization which necessitates equipment design changes occurs late in the design cycle, resulting in a need for additional equipment manufacturer lead time. The equipment manufacturer flexibilities adopted in today's rule accommodate these possibilities.

We have specific objections to Ingersoll-Rand's preferred approach of a mandated made available date, followed by 18 months of additional lead time for equipment manufacturers. Superimposing a government mandate on the engine maker - equipment manufacturer business relationship insinuates EPA into the middle of contractual/market relationships (e.g., when is an objectively reasonable delivery date?), forcing EPA to prejudge myriad differing business relationships/engineering situations. Moreover, selection of any single made available date is bound to be arbitrary in most situations. We also believe that the 18-month lead time following a made available date entails a mandated 18-month period (at least) with no return on investment to engine suppliers (i.e. the period between when the Tier 4 engine would be produced and when it could lawfully be sold), which would increase the engine cost, and discourage design changes (since such changes would entail more investment with delayed return on that investment). The ultimate result would be a costlier rule and less environmental benefit due to the delay in introducing Tier 4 engines. Even were EPA to put forth such a regulation, it is not clear that it could be enforced or that it would help the situation. It would only be natural for engine manufacturers to continue to improve its products even after the predefined "made available date" and equipment manufacturers would want to use this improved product even if it meant they had to make last minute changes to the equipment design. For EPA to preclude engine manufacturers from changing their product designs over the period between the certification date and the equipment manufacturer date would be both unusual and counterproductive to our goal

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[64] "Tier 4 Nonroad Diesel Equipment Flexibility Provisions," memorandum from Byron Bunker, et. al., (EPA) to EPA Air Docket OAR-2003-0012.

of seeing the best possible products available in the market. Moreover, EPA sees no need to interfere with the concurrent design market mechanism, which allows engine makers and equipment manufacturers to negotiate optimal solutions. We believe it is better to leave to the market participants the actual decision for how and when to conduct concurrent engineering designs.

The California Air Resources Board commented that EPA should eliminate or reduce the amount of flexibilities provided for less than 25 horsepower engines, because the Tier 4 engine standards are not aftertreatment-based. The Engine Manufacturers Association commented that we should expand the amount of flexibilities for engines greater than 750 horsepower, given the difficulty of complying with the proposed standards for engines above 750 horsepower. With today's action, we are applying the same flexibility for all power categories, including engines below 25 horsepower and engines above 750 horsepower. While it is true that the Tier 4 standards for engines below 25 horsepower are not aftertreatment-based, we believe there will be changes in engine design for many of those engines in response to the Tier 4 standards. As engine designs change, there is the potential for impacts on equipment design as well (as shown in implementing the Tier 2/3 rule). Therefore, we believe providing equipment manufacturer flexibility for engines below 25 horsepower is appropriate and we are adopting the same flexibilities for engines below 25 horsepower as for other power categories. With regard to engines above 750 horsepower, we are retaining the same flexibilities for those engines as for other power categories. As described in section II.A.4, the Tier 4 standards being adopted today for engines above 750 horsepower have been revised from the proposal. We believe that these revisions have appropriately accommodated concerns for the most difficult to design applications (i.e., NO_X adsorbers for engines in mobile applications), so that additional equipment flexibilities are not warranted for these engines.

The Engine Manufacturers Association commented that some equipment manufacturers may be capable of making an on-time transition to the interim Tier 4 standards (e.g. the 2011 standards applicable for 175-750 horsepower engines) without the use of flexibilities. Such equipment manufacturers would like the ability to start the seven-year period in which they may use flexibilities in the year the final Tier 4 standards (the aftertreatment-based standards for both PM and NO_X) take effect. Put another way, they would not need more lead time for equipment to meet the interim standards, but could need more lead time for equipment required to meet the final standards. In addition, the commenter suggested a modified approach that could lead to earlier emission reductions than under the proposed rule: requiring delayed flexibility engines to meet the interim Tier 4 standards instead of meeting the Tier 2/3 standards (as would have been allowed under the proposal if the flexibilities started in the first year of the interim Tier 4 standards).

EPA wants to encourage the implementation of the Tier 4 standards as early as possible. Therefore, we believe it makes sense to provide incentives to equipment manufacturers to use interim Tier 4 compliant engines in their equipment during the transition to the final Tier 4 standards. Moreover, it is reasonable to expect that more lead time will be needed for the

aftertreatment-based standards than for the interim standards. Therefore, in response to these comments, we are revising the proposed flexibility provisions to allow equipment manufacturers to have the option of starting the seven-year period in which flexibility engines may be used in either the first year of the interim Tier 4 standards or the first year of the final Tier 4 standards. For engines between 25 and 75 horsepower, the final Tier 4 standards may begin in 2012 or 2013 depending on whether the manufacturer chooses to comply with the interim 2008 Tier 4 standards. An equipment manufacturer who does not use flexibilities in 2008 thus may need flexibilities as early as 2012. Therefore, the seven-year period for the final Tier 4 standards for engines between 25 and 75 horsepower will begin in 2012 instead of 2013. Moreover, it is clearly appropriate that these delayed flexibility engines meet the interim Tier 4 standards, in order not to backslide from existing levels of performance.

Table III.B-1 shows the years in which manufacturers could choose to start the Tier 4 flexibilities given the standards being adopted today. (The seven-year period for engines below 25 horsepower takes effect in 2008 as proposed, because there are no interim standards for such engines.)

Table III.B-1. – Flexibility Periods for the Tier 4 Standards

Power Category	Model Year Flexibility Period Options	Standards to which Flexibility Engines would have to Certify
25 ≤ hp < 75 (19 ≤ kW < 56)	2008-2014	Tier 2 standards
	2012-2018	Model Year 2008 Tier 4 standards
75 ≤ hp < 175 (56 ≤ kW <130)	2012-2018	Tier 3 standards
	2014-2020	Model Year 2012 Tier 4 standards
175 ≤ hp ≤ 750 (130 ≤ kW ≤ 560)	2011-2017	Tier 3 standards
	2014-2020	Model Year 2011 Tier 4 standards
>750 hp (>560 kW)	2011-2017	Tier 2 standards
	2015-2021	Model Year 2011 Tier 4 standards

Under today's action, and as proposed, only those nonroad equipment manufacturers that install engines and have primary responsibility for designing and manufacturing equipment will qualify for the allowances or other relief provided under the Tier 4 transition provisions. As a result of this definition, importers that have little involvement in the manufacturing and assembling of the equipment will be ineligible to receive any allowances. The Engine

Manufacturers Association and one engine manufacturer commented that the proposed definition of equipment manufacturer needed to be revised to cover situations in which a manufacturer contracts out the design and production of equipment to another manufacturer. While we understand there are many different types of relationships between equipment manufacturers, we believe it is important to establish firm criteria for determining eligibility to use the equipment manufacturer allowances. We are concerned that the change to the equipment manufacturer definition suggested by the commenters would allow entities that have little or no involvement in the actual design, manufacture and assembly of equipment (e.g., companies that only import equipment) to claim they contracted with an equipment manufacturer to produce equipment for them and therefore claim allowances. This is the exact situation we are attempting to prevent with the changes to the eligibility requirements for the allowances. Therefore, we are adopting the proposed requirement that only those nonroad equipment manufacturers that install engines and have primary responsibility for designing, and manufacturing equipment will qualify for the allowances or other relief provided under the Tier 4 transition provisions. However, we are revising the provisions regarding which engines an equipment manufacturer may include in its total count of U.S.-directed equipment production, which in turn affects the number of allowances an equipment manufacturer may claim. Under today's action, an equipment manufacturer may include equipment produced by other manufacturers under license to them for which they had primary design responsibility (see section 1039.625(a) of the regulations). This should cover the type of situation described by the commenters while preventing an import-only entity from claiming it is an equipment manufacturer and thereby gaining access to the allowances.

a. Percent-of-Production Allowance

Under the percent-of-production allowance adopted today, each equipment manufacturer will be allowed to install engines not certified to the Tier 4 emission standards in a limited percentage of machines produced for the U.S. market. Equipment manufacturers will need to provide written assurance to the engine manufacturer that such engines are being procured for the purpose of the transition provisions for equipment manufacturers. These engines will instead have to be certified to the standards that would apply in the absence of the Tier 4 standards (see Table III.B-1 for the applicable standards). As proposed, this percentage will apply separately to each of the Tier 4 power categories (engines below 25 horsepower, engines between 25 and 75 horsepower, engines between 75 and 175 horsepower, engines between 175 and 750 horsepower, and engines above 750 horsepower) and is expressed as a cumulative percentage of 80 percent over the seven years beginning when the Tier 4 standards apply in a category (see Table III.B-1 for the applicable seven-year periods). No exemptions will be allowed after the seventh year. For example, an equipment manufacturer could install engines certified to the Tier 3 standards in 40 percent of its entire 2011 production of nonroad equipment that use engines rated between 175 and 750 horsepower, 30 percent of its entire 2012 production in this horsepower category, and 10 percent of its entire 2013 production in this horsepower category. (During the transitional period for the Tier 4 standards, the fifty percent of engines that are allowed to certify to the previous tier NO_X standard but meet the Tier 4 PM standard are considered Tier 4-compliant

engines for the purpose of the equipment manufacturer transition provisions.) If the same manufacturer produces equipment using engines rated above 750 horsepower, a separate cumulative percentage allowance of 80 percent will apply to those machines during the seven years beginning in 2011 or 2015. This percent-of-production allowance is almost identical to the percent-of-production allowance adopted in the October 1998 final rule (63 FR 56967, October 23, 2003), the difference being, as explained earlier, that there are fewer power categories (and consequent increased flexibility in spreading the flexibility among engine families) associated with the Tier 4 standards.

The 80 percent exemption allowance, were it to be used to its maximum extent by all equipment manufacturers, will bring about the introduction of cleaner engines several months later than would have occurred if the new standards were to be implemented on their effective dates. However, the equipment manufacturer flexibility program has been integrated with the standard-setting process from the initial development of this rule, and as such we believe it is a key factor in assuring that there is sufficient lead time to initiate the Tier 4 standards according to the final implementation schedule.[65]

As proposed, machines that use engines built before the effective date of the Tier 4 standards do not have to be included in an equipment manufacturer's percent of production calculations under this allowance. Machines that use engines certified to the previous tier of standards under our Small Business provisions (as described in section III.C of this preamble) do not have to be included in an equipment manufacturer's percent of production calculations under this allowance. All engines certified to the Tier 4 standards, including those engines that produce emissions at higher levels than the standards, but for which an engine manufacturer uses ABT credits to demonstrate compliance, will count as Tier 4 complying engines and do not have to be included in an equipment manufacturer's percent of production calculations. Engines that meet the Tier 4 PM standards but are allowed to meet the Tier 3 NMHC+NO_X standards during the phase-in period also count as Tier 4 complying engines and do not have to be included in an equipment manufacturer's percent of production calculations.

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[65] As explained at proposal, for emissions modeling purposes, we have assumed that manufacturers take full advantage of the allowances under the existing transition program for equipment manufacturers (adopted in the October 1998 rule; see 63 FR 56967 (October 23, 2003) in establishing the baseline emissions inventory. In modeling the impact of the Tier 4 standards, because the standards will not take effect for many years and it is not possible to accurately forecast use of the transition program for equipment manufacturers, so to assess costs in a conservative manner, we have assumed that all engines will meet the Tier 4 standards in the timeframe required by the standards without use of the Tier 4 transition provisions. As discussed in section VI.C, this is consistent with our cost analysis, which assumes no use of the transition program for equipment manufacturers.

The choice of a cumulative percent allowance of 80 percent is based on our best estimate of the degree of reasonable lead time needed by equipment manufacturers. We believe the 80 percent allowance responds to the need for flexibility identified by equipment manufacturers, while ensuring a significant level of emission reductions in the early years of the program. (As noted in the following section III.B.2.b, we are adopting a technical hardship provision that allows an equipment manufacturer to request additional relief under the percent of production allowance under certain conditions and with EPA approval.)

b. Technical Hardship Flexibility

Ingersoll-Rand commented that the 80% percent of production allowance level is not sufficient for Tier 4 given the stringency of the standard and the difficulty engine manufacturers will have complying with the standards. In further discussions with Ingersoll-Rand on this issue, they suggested that a percent of production allowance level of 150% for totally non-integrated equipment manufacturers (i.e., equipment manufacturers producing no diesel engines) was appropriate for Tier 4 power categories above 25 horsepower. A fully integrated manufacturer would still receive the 80% level and partially-integrated companies would receive somewhere between 80% and 150% depending on the share of self-produced engines in each specific power category. The basis for this comment is their belief that non-integrated manufacturers are at a disadvantage to integrated manufacturers (manufacturers making both the engine and equipment) when it comes to planning for new Tier 4 engine designs.

Although we do not accept the premise that equipment manufacturer lead time must be drastically expanded across-the-board for the Tier 4 program, we do agree, as explained earlier, that there may be situations where additional lead time, in the form of increased equipment manufacturer transition flexibilities, can be justified. Therefore, we have added an additional flexibility (which has no direct analogue in the Tier 2/3 rule) to this rule in order to provide additional needed lead time in appropriate, individualized circumstances based on a showing of extreme technical or engineering hardship. Ingersoll-Rand has agreed, by letter to EPA, that this provision satisfies all of its concerns regarding adequacy of lead time for meeting Tier 4 standards.

This additional flexibility would be available for the three Tier 4 power categories between 25 and 750 horsepower. As noted earlier, Ingersoll-Rand did not believe additional flexibility was needed for engines below 25 horsepower. We agree because the Tier 4 standards for engines below 25 horsepower are not based on the use of advanced aftertreatment. We also are not including this new provision for engines above 750 horsepower because nearly all of the equipment manufacturers utilizing engines above 750 horsepower make small volumes of equipment. The small-volume allowance (described in the following section) allows a manufacturer to exempt a specific number of engines over a seven-year period, which in most cases will be greater than the increased percentage potentially available under this new provision.

This new provision, found in new section 1039.625(m), is a case-by-case exemption granted by EPA to an equipment manufacturer. The equipment manufacturer would have the burden of demonstrating existence of extreme technical or engineering hardship conditions that are outside its control. It must also demonstrate that it has exercised reasonable due diligence to avoid the situation. EPA would treat each request for technical hardship separately, with no guarantee that it would grant the exemption. If EPA grants the exemption, the equipment manufacturer could receive up to an additional 70 percent under the percent of production allowance for each of the three power categories noted above (meaning that there is a potential total 150 percent under the percent of production allowance available, the initial 80 percent available without application, and an additional potential increment of up to 70 percent available on a case-by-case basis).

The exemption could only be granted upon written application to EPA setting forth essentially why the normally successful elements of engine maker/equipment manufacturer design cycle have not provided adequate lead time for a particular equipment model. The application would therefore have to address, with documentation: the engineering or technical problems that have proved unsolvable within the lead time provided, the normal design cycle between the engine maker and equipment manufacturer and why that cycle has not worked in this instance, all information (such as written specifications, performance data, prototype engines) the equipment manufacturer has received from the engine supplier, and a comparison of the design process for the equipment model for which the exemption is requested with the design process for other models for which no exemption is needed. The equipment manufacturer also would have to make and describe all efforts to find other compliant engines for the model. EPA will then evaluate and determine whether or not to grant each such request, and what additional increment under the percent of production allowance (above the 80 percent normally allowed) is justified (not to exceed an additional 70 percent as noted above). As part of our evaluation of requests based on technical hardship, we may contact the engine supplier(s) listed by the equipment manufacturer to check on the accuracy of the engine-related information supplied by the equipment manufacturer. This extension of lead time is premised on the existence of extreme technical or engineering problems, in contrast to the economic hardship provision described in section III.B.2.f below, where consideration of economic impact is critical.

EPA would not grant an application for technical hardship exemption unless the equipment manufacturer demonstrates that the full 80 percent allowed under the percent of production allowance is reasonably expected to be used up in the first two years of the seven-year flexibility period. The reason is obvious. If that allowance would not be fully utilized, then no further extension of lead time can be justified. Furthermore, any technical hardship allowance would have to be used up within two years after the Tier 4 percent of production allowances start for any power category. This is because, although we believe that circumstances of extreme technical or engineering hardship may arise, we cannot see that these circumstances could not be solved within the first two years of the transition. Indeed, Ingersoll-Rand itself clearly indicated that this is a temporary burden which exists during initial model transition and indicated that only 18 months (rather than two years) could be needed from receipt of the certified engine.

This flexibility will be available to all equipment manufacturers, but may only be requested for equipment in which the equipment manufacturer is different than the engine manufacturer. We believe that integrated manufacturers who produce both the equipment and the engine used in the piece of equipment could have an advantage in the equipment redesign process (compared to an equipment manufacturer, whether integrated or not, that uses engines from a different manufacturer) that makes additional relief under the percent of production allowance unnecessary. In addition, integrated equipment manufacturers have other programs available to them (that non-integrated manufacturers do not have) such as the engine averaging, banking and trading program, which can provide lead time flexibility during the transition years. Most basically, integrated manufacturers should be able to design concurrently in all circumstances, so that extreme technical or engineering hardships should not arise.

c. Small-Volume Allowance

The percent-of-production approach described above may provide little benefit to businesses focused on a small number of equipment models, and hence there could be situations where there is insufficient lead time for such models. Therefore, with today's action, we are adopting a small-volume allowance that will allow any equipment manufacturer to exceed the percent-of-production allowances described above during the same seven-year period, provided the manufacturer limits the number of exempted engines to 700 total over the seven years, and to 200 in any one year. The limit of 700 exempted engines (and no more than 200 engines per year) applies separately to each of the Tier 4 power categories (engines below 25 horsepower, engines between 25 and 75 horsepower, engines between 75 and 175 horsepower, engines between 175 and 750 horsepower, and engines above 750 horsepower). In addition, manufacturers making use of this provision must limit exempted engines to a single engine family in each Tier 4 power category.

We are also adopting an alternative small-volume allowance, which equipment manufacturers have the option of utilizing. In discussions regarding the current small-volume allowance, some manufacturers expressed the desire to be able to exempt engines from more than one engine family, but still fall under the number of exempted engine limit. For that reason, we solicited comment on a small-volume allowance program that would allow manufacturers to exempt engines in more than one family, but have lower numerical limits. Under this alternative, manufacturers using the small-volume allowance could exempt 525 machines over seven years (with a maximum of 150 in any given year) for each of the three power categories below 175 horsepower, and 350 machines over seven years (with a maximum of 100 in any given year) for the two power categories above 175 horsepower. Concurrent with the revised caps of 525 or 350, depending on power category, manufacturers could exempt engines from more than one engine family under the small-volume allowance program. Based on sales information for small businesses, we estimated that the alternative small-volume allowance program to include lower numbers of eligible engines and allow manufacturers to exempt more than one engine family would keep the total number of engines eligible for the allowance at roughly the same overall

level as the 700-unit program.[66] We also requested comment on allowing equipment manufacturers to choose between the two small-volume allowance programs described above (68 FR 28474-28475, May 23, 2003).

Both engine and equipment manufacturers supported dropping the one engine family restriction from the 700 unit small-volume allowance. In addition, they commented that if the one engine family restriction was not dropped from the 700 unit option, they supported the option of allowing equipment manufacturers to choose between the two small-volume allowance options. With today's action, we are revising the proposed small-volume allowance to allow equipment manufacturers to choose between the 700 unit over seven years option, with exempted engines limited to one engine family, or the proposed alternative which would allow equipment manufacturers to exempt fewer engines over seven years (525 or 350 units, depending on the power category), but with no restriction on the number of engine families that could be included in the exempted engine count. Based on our analysis of small businesses noted above, we expect the number of engines that could be exempted under either option is roughly the same. Giving equipment manufacturers the ability to choose between the two options should not significantly impact the number of engines likely to be exempted under the small-volume allowance. We have not chosen to drop the one engine family restriction from the 700-unit small-volume allowance because it would result in a significant increase in the number of engines eligible to be exempted to levels which we believe are not needed to provide adequate lead time for the Tier 4 program.[67]

As with the percent-of-production allowance, machines that use engines built before the effective date of the Tier 4 standards do not have to be included in an equipment manufacturer's count of engines under the small-volume allowance. Similarly, machines that use engines certified to the previous tier of standards under our Small Business provisions (as described in section III.C of today's action) do not have to be included in an equipment manufacturer's count of engines under the small-volume allowance. All engines certified to the Tier 4 standards, including those that produce emissions at higher levels than the standards but for which an engine manufacturer uses ABT credits to demonstrate compliance, will be considered to be Tier 4 complying engines and do not have to be included in an equipment manufacturer's count of engines under the small-volume allowance. Engines that meet the Tier 4 PM standards but are allowed to meet the Tier 3 NMHC+NO_X standards during the phase-in period (i.e., phase-out engines) will also be considered as Tier 4 complying engines and do not have to be included in an equipment manufacturer's count of engines under the small-volume allowance. All engines used under the small-volume allowance must certify to the standards that would be in effect in the absence of the Tier 4 standards (see Table III.B-1 for the applicable standards). As noted

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[66] "Analysis of Small Volume Equipment Manufacturer Flexibilities," memo from Phil Carlson (EPA) to Docket A-2001-28.

[67] Memorandum, Phil Carlson to Docket A-2001-28, "Analysis of Equipment Manufacturer Flexibilities," April 15, 2003. Docket A-2001-28, document no. II-B-24.

earlier, equipment manufacturers will need to provide written assurance to the engine manufacturer when it purchases engines under the transition provisions for equipment manufacturers.

The Engine Manufacturers Association commented that the proposed regulations for the small-volume allowance established a limit on the total number of engines an equipment manufacturer could use that did not meet the Tier 4 standards and should be revised to set a limit based on U.S.-directed production (consistent with the proposed regulatory language for the percent-of-production allowance). EPA agrees that the limit under the small-volume allowance should apply to U.S.-directed production only - as the commenter surmised, this is what EPA intended - and has revised the final regulations for the small-volume allowance accordingly.

We are also finalizing a technical hardship provision for small business equipment manufacturers using 25-50 horsepower engines, as discussed in III.C.2.b.ii

d. Early Use of Tier 4 Flexibilities in the Tier 2/3 Timeframe

As proposed, we are also adopting provisions that allow equipment manufacturers to start using a limited number of the new Tier 4 percent of production allowances or Tier 4 small volume allowances once the seven-year period for the existing Tier 2/Tier 3 program expires (and so continue using engines meeting Tier 1 or Tier 2 standards). In this way, a manufacturer can potentially continue exempting the most difficult applications once the seven-year period of the current Tier 2/3 flexibility provisions is finished. (Under the existing transition program for equipment manufacturers, any unused Tier2/3 allowances expire after the seven-year period.) However, opting to start using Tier 4 allowances once the seven-year period from the current Tier 2/Tier 3 program expires will reduce the number of exemptions available from the Tier 4 standards under either the percent of production allowance or the small volume allowance.

With today's action, equipment manufacturers may use up to a total of 10 percent of their Tier 4 percent of production allowances or up to 100 of their Tier 4 small volume allowances prior to the effective date of the Tier 4 standards. (The early use of Tier 4 allowances will be allowed in each Tier 4 power category.) This amount of equipment utilizing the early Tier 4 allowances will be subtracted from either the Tier 4 allowance of 80 percent under the percent of production allowance or the applicable limit under the small volume allowance for the appropriate power category, resulting in fewer allowances once the Tier 4 standards take effect. For example, if an equipment manufacturer uses the maximum amount of early Tier 4 percent of production allowances of 10 percent, then the manufacturer will have a cumulative total of 70 percent remaining for that power category when the Tier 4 standards take effect (i.e., 80 percent production allowance minus 10 percent).

The California Air Resources Board commented that we should discount the early use of Tier 4 flexibilities to discourage abuse of the provisions, by requiring equipment manufacturers to give up more than one flexibility after Tier 4 begins for every flexibility used prior to Tier 4.

California did not specifically recommend what the discount level should be. We are not adopting a discount for early use of the Tier 4 flexibilities. The intent of allowing manufacturers to use the Tier 4 flexibilities early was to allow them to carry over the few remaining equipment models that might not have been redesigned at the end of the seven-year Tier 2/Tier 3 flexibility period until Tier 4 begins, and not requiring a possible double redesign in a short period of time. Because we have placed a relatively low cap (10% under the percent of production allowance or 100 units under the small volume allowance) on the amount an equipment manufacturer could use early from Tier 4, we do not believe that manufacturers will be able to abuse the program and therefore should not have to discount the number of Tier 4 flexibilities used early.

We view this provision on early use of Tier 4 allowances as providing reasonable lead time for introducing Tier 4 engines, since it should result in earlier introduction of Tier 4-compliant engines (assuming that the allowances would otherwise be fully utilized) with resulting net environmental benefit (notwithstanding longer utilization of earlier Tier engines, due to the stringency of the Tier 4 standards) and should do so at net reduction in cost by providing cost savings for the engines that have used the Tier 4 allowances early. (This is another reason we see no reason to discount the allowance.)

e. Early Tier 4 Engine Incentive Program for Equipment Manufacturers

Ingersoll-Rand commented that non-integrated equipment manufacturers who incorporate Tier 4 compliant engines into their equipment prior to the applicable date for the Tier 4 standards should be able to earn early compliance credits. These early compliance credits could allow use of the previous-tier engine (above and beyond the base percentage granted under the flexibility program) for up to 18 months after the certification date of the engine. Ingersoll-Rand also commented that such early compliance credits should be able to be traded across power categories with appropriate weightings applied.

We believe a program that provides an incentive for equipment manufacturers to use early Tier 4-compliant engines is worthwhile from both a technology development perspective and an environmental perspective. As we noted at proposal when we proposed a similar incentive program for engine makers, early use of Tier 4 compliant engines will help foster technology development by getting the Tier 4 technologies out in the market early and provide real-world experience to manufacturers and users (68 FR 28482, May 23, 2003). It will also lead to additional emission reductions above and beyond those expected under the existing Tier 2/3 standards in the years prior to Tier 4 taking effect. Moreover, equipment manufacturers (and especially non-integrated equipment manufacturers) are unlikely to buy early Tier 4 engines without some incentive to do so since these engines are likely to be more expensive than Tier 2/3 engines. For these reasons, we are adopting new provisions that will allow any equipment manufacturer to earn early compliance credits that could be used to increase the number of equipment flexibilities above and beyond the levels allowed under the percent of production allowance or small-volume allowance (and for reasons independent of those allowances: namely, an inducement to make early use of Tier 4 engines).

The program will be available to all equipment manufacturers regardless of whether they are integrated or non-integrated. While Ingersoll-Rand commented that the program should be available to non-integrated equipment manufacturers only, we believe the program should provide an incentive for all equipment manufacturers to use early Tier 4 engines (since the benefits accruing from early use of such engines exist regardless of whether the equipment manufacturer is integrated with the engine maker).

Before describing this provision further, it is desirable to put it in context by explaining its relationship to the engine manufacturer incentive program for early Tier 4 or very low emission engines (described in section III.M below), as well as to the similar incentive provisions for engine manufacturers which we proposed (68 FR 28482, May 23, 2003). We are, in essence, redirecting the proposed incentive for using early Tier 4 compliant engines to equipment manufacturers. Thus, under today's rule, an engine manufacturer could use the incentive program (as described in section III.M) only if an equipment manufacturer uses an early Tier 4 engine but (for whatever reason) declines to use the early engine flexibility allowance. In such a case, the engine manufacturer could opt to earn either "engine offsets" (which would allow them to make fewer engines certified to the Tier 4 standards once the Tier 4 program takes effect) or ABT credits, but not both. In the more likely case of an equipment manufacturer using early Tier 4 engines and using the incentive flexibilities itself, the engine manufacturer would be eligible to generate ABT credits from such early Tier 4 compliant engines.

The early Tier 4 engine incentive program for equipment manufacturers will apply to the four power categories above 25 horsepower where the use of advanced exhaust aftertreatment is expected under the Tier 4 standards. Because the Tier 4 standards for engines below 25 horsepower are not expected to result in the use of advanced aftertreatment technologies, we are not including such engines in the program.

In order for an engine to be considered an early Tier 4 compliant engine, it will need to be certified to the final Tier 4 standards for PM, NO_X, and NMHC (i.e., the 2013 standards for engines between 25 and 75 horsepower, the 2014 standards for engines between 75 and 175 horsepower, the 2014 standards for engines between 175 and 750 horsepower, and the 2015 standards for engines above 750 horsepower) or to the final PM and NMHC standards and the alternative NO_X standards during the phase-in (as described in section II.A.2.c of today's rule for engines between 75 and 750 horsepower). In order to be an early Tier 4 compliant engine, these engines would also have to certify to the Tier 4 CO standards. Because 15 ppm sulfur diesel fuel will be available on a widespread basis in time for 2007 (due to the requirements for on-highway heavy-duty engines), we are allowing engine manufacturers to begin certifying engines to the Tier 4 standards, and therefore have engines eligible for the early Tier 4 engine incentive program, beginning with the 2007 model year.

In order to provide assurance that early Tier 4 compliant engines are placed into equipment earlier than would otherwise happen under the Tier 4 program, engine manufacturers will be required to certify and start producing such engines before September 1 of the year prior

to the post-2011 Tier 4 standards taking effect or before September 1, 2010 for engines in the 175 to 750 horsepower category. Similarly, equipment manufacturers will be required to install such engines in equipment before January 1 of the year the post-2011 Tier 4 standards take effect or before January 1, 2011 for engines in the 175 to 750 horsepower category. In addition, in order to be considered an early Tier 4 compliant engine, such engines would be required to comply with all of the requirements associated with the final Tier 4 standards such as NTE requirements, transient testing (where otherwise required for certification, i.e. for 25-750 horsepower engines), and closed crankcase requirements. Finally, for engines certified prior to model year 2011, the engine manufacturer would be allowed to demonstrate early compliance with the Tier 4 standards on a 15 ppm sulfur fuel (as allowed under the certification fuel requirements specified in section III.D of today's rule) provided the engine manufacturer demonstrates that the equipment in which the engines are placed will use fuel meeting this low sulfur specification and includes appropriate information on the engine label and ensures that ultimate purchasers of equipment using these engines are informed that ultra low-sulfur diesel fuel is recommended (see section 1039.104(e) of the regulations). Equipment manufacturers using such pre-2011 engines in their equipment would likewise need to take steps to ensure that fuel meeting this low sulfur specification is used in the equipment once operated in use to earn the additional flexibility allowances.

Equipment manufacturers installing engines complying with the final Tier 4 standards (as described above) would earn one flexibility allowance for each early Tier 4 compliant engine used in its equipment. Equipment manufacturers installing engines between 75 and 750 horsepower that comply with the final Tier 4 PM standard and the alternative NO_X standard (described in section II.A.2.c) would earn one-half of a flexibility allowance for each early Tier 4 compliant engine used in its equipment. Table III.B-2 presents the requirements an engine would need to meet to be considered an early Tier 4 engine for the purposes of this early Tier 4 engine incentive program.

Table III.B-2. – Requirements for Engines Under the Early Tier 4 Engine Incentive Program

Power Category	Tier 4 Standards the Engines Must Meet	Date before which Engines must Be Installed by the Equipment Manufacturer	Number of Flexibility Allowances Earned for Use of Early Tier 4 Engines
25 ≤ hp < 75 (19 ≤ kW < 56)	Model Year 2013	January 1, 2013[a]	1-to-1
75 ≤ hp < 175 (56 ≤ kW <130)	Model Year 2014	January 1, 2012	1-to-1
	Model Year 2012[b]	January 1, 2012	0.5-to-1
175 ≤ hp ≤ 750 (130 ≤ kW ≤ 560)	Model Year 2014	January 1, 2011	1-to-1
	Model Year 2011[b]	January 1, 2011	0.5-to-1
Generator Sets >750 hp (>560 kW)	Model Year 2015	January 1, 2015	1-to-1
Other Machines >750 hp (>560 kW)	Model Year 2015	January 1, 2015	1-to-1

Notes:
[a] The installation date for 50 to 75 horsepower engines purchased from manufacturers choosing to opt out of the 2008 model year Tier 4 standards and instead comply with the Tier 4 standards beginning in 2012 would be January 1, 2012.
[b] To be eligible, engines must meet the 0.01g/bhp-hr PM standard and the alternative NO_X standards in section 1039.102 (e) described in section II.A.2.c.

As described above, equipment manufacturers using early Tier 4 compliant engines can earn flexibility allowances that can be used to effectively increase the number of allowances provided under the percent of production allowance or the small volume allowance in the same power category. For example, an equipment manufacturer that uses 500 engines in the 175 to 750 horsepower category that met the model year 2011 PM standards and alternative NO_X standards would earn 250 additional flexibility allowances in that power category. That manufacturer could then exclude 250 engines from its calculations before demonstrating compliance with the 80 percent limit under the percent of production allowance (or the applicable limit under the small volume allowance if the equipment manufacturer is using that option) once Tier 4 starts in that power category.

Equipment manufacturers would be required to report certain information regarding the early Tier 4 compliant engines (such as engine family name, number of engines used prior to Tier 4 in each power category, the rated power of the engines, and the type of application the engines above 750 horsepower were used in) when they submit their first report under the Tier 4 flexibility program. For engines above 750 horsepower, equipment manufacturers also would be required to keep records of how many early Tier 4 compliant engines are used in generator sets, versus how many are used in other machinery. This is because the additional flexibility allowances earned from the use of early Tier 4 compliant engines used in generator sets could only be used for additional flexibility allowances for generator sets. Likewise, the additional flexibility allowances earned from the use of early Tier 4 compliant engines used in mobile machinery (labeled 'other machinery' in the table above) applications could only be used for additional flexibility allowances for other non-generator set applications.

Under the early Tier 4 engine incentive program, we will allow equipment manufacturers to "trade" the additional flexibilities earned in the two power categories between 75 and 750 horsepower, with the power rating of the engines factored into the "trade" to ensure equivalent emissions for the engines generating the early allowances and the engines using the allowances. For example, an equipment manufacturer that earned 100 additional flexibility allowances under the early Tier 4 engine incentive program from 100 horsepower engines, could "trade" those flexibilities into the next power category up (175 to 750 horsepower). The equipment manufacturer would generate 10,000 horsepower-allowances from those early engines (i.e., 100 horsepower times 100 allowances). The equipment manufacturer could then produce, for this example, an additional 25 engines with a power rating of 400 horsepower above and beyond the normal limit on allowances (or any other combination of engines such that the sum of the horsepower-weighted allowances adds up to the 10,000 horsepower-allowances used in this example). We are not allowing trading for engines in the 25 to 75 horsepower category because the Tier 4 standards for these engines are based on the application of only PM aftertreatment technology. Similarly, we are not allowing trading for engines in the above 750 horsepower category because the Tier 4 standards are based on the application of PM aftertreatment to all engines, but NO_X aftertreatment for only some engines.

f. Economic Hardship Relief Provision

With today's action, and as proposed, we are providing an additional Tier 4 transition flexibility for "economic hardship relief" for equipment manufacturers. Under the economic hardship relief provisions, an equipment manufacturer that does not make its own engines could obtain limited additional relief by providing evidence that, despite its best efforts, it cannot meet the implementation dates, even with the Tier 4 equipment flexibility program provisions outlined above. Such a situation could occur if an engine supplier without a major business interest in the equipment manufacturer were to change or drop an engine model very late in the implementation process. The purpose of the provision is to redress individual situations of extreme economic hardship, not merely to perpetuate existing market share. That is, if situations arise where one equipment maker cannot produce equipment using Tier 4-compliant engines by the compliance

date, but another can, ordinarily EPA would not adjust the program to allow use of the non-compliant application absent extreme, compelling equitability considerations.

Applications for economic hardship relief will have to be made in writing, and will need to be submitted before the earliest date of noncompliance. The application will also have to include evidence that failure to comply is not the fault of the equipment manufacturer (such as a supply contract broken by the engine supplier), and include evidence that serious economic hardship to the company will result if relief is not granted. (As explained in section III.B.2.b above, this is a significant difference between this economic hardship provision and the technical hardship flexibility, where consideration of cost is generally irrelevant.) We expect to work with the applicant to ensure that all other remedies available under the flexibility provisions are exhausted before granting additional relief (if appropriate), and place a limit on the period of relief to no more than one year. Applications for economic hardship relief generally will only be accepted during the first year after the effective date of an applicable new emission standard.

The Agency expects this provision will be rarely used. This expectation has been supported by our initial experience with the Tier 2 standards in which only one equipment manufacturer has applied under the existing hardship relief provisions (and the request was subsequently denied). Requests for economic hardship relief will be evaluated by EPA on a case-by-case basis, and may require, as a condition of granting the applications, that the equipment manufacturer agree (in writing) to some appropriate measure to recover the lost environmental benefit.

Ingersoll-Rand commented that the provisions regarding eligibility for hardship relief should be revised so that they do not require a demonstration of severe economic hardship, noting that such a showing would invariably preclude large entities (like Ingersoll-Rand) from utilizing the provision, even though delays were beyond their control. As described earlier in this section, we have included an additional flexibility in the Tier 4 rule in order to provide additional needed lead time in appropriate, individualized circumstances based on a showing of extreme technical or engineering hardship. We believe the provisions of the technical hardship address the concerns noted by Ingersoll-Rand in their comments, and therefore we are not revising the existing economic hardship relief provisions (which require a demonstration of severe economic impact) for the Tier 4 final program.

g. Existing Inventory Allowance

The current program for nonroad diesel engines includes a provision for equipment manufacturers to continue to use engines built prior to the effective date of new standards, until the older engine inventories are depleted. It also prohibits stockpiling of previous tier engines. As proposed, we are extending these provisions for the transition to the Tier 4 standards adopted today. We are also extending the existing provision that provides an exception to the applicable compliance regulations for the sale of replacement engines. In extending this provision, we are requiring that engines built to replace certified engines be identical in all material respects to an

engine of a previously certified configuration that is of the same or later model year as the engine being replaced. The term "identical in all material respects" allows for minor differences that would not reasonably be expected to affect emissions such as a change in materials or a change in the company supplying the components of the engine.

3. What are the recordkeeping, notification, reporting, and labeling requirements associated with the equipment manufacturer transition provisions?

The following section describes the recordkeeping, notification, reporting, and labeling requirement being adopted today. As proposed, failure to comply with these requirements will subject the noncomplying party to penalties as described in 40 CFR 1068.101.

a. Recordkeeping Requirements for Engine and Equipment Manufacturers

With today's action, we are extending the recordkeeping requirements from the current equipment manufacturer transition program. Under the Tier 4 transition program, engine manufacturers will be allowed to continue to build and sell previous tier engines needed to meet the market demand created by the equipment manufacturer flexibility program, provided they receive written assurance from the engine purchasers that such engines are being procured for this purpose. Engine manufacturers will be required to keep copies of the written assurance from the engine purchasers for at least five full years after the final year in which allowances are available for each power category.

Equipment manufacturers choosing to take advantage of the Tier 4 allowances will be required to: (1) keep records of the production of all pieces of equipment excepted under the allowance provisions for at least five full years after the final year in which allowances are available for each power category; (2) include in such records the serial and model numbers and dates of production of equipment and installed engines, and the rated power of each engine, (3) calculate annually the number and percentage of equipment made under these transition provisions to verify compliance that the allowances have not been exceeded in each power category; and (4) make these records available to EPA upon request.

b. Notification Requirements for Equipment Manufacturers

We are adopting new notification requirements for equipment manufacturers with the Tier 4 program. Under the Tier 4 transition program, equipment manufacturers wishing to participate in the Tier 4 transition provisions will be required to notify EPA prior to their use of the Tier 4 transition provisions. Equipment manufacturers will be required to submit their notification before the first calendar year in which they intend to use the transition provisions. We believe that prior notification will greatly enhance our ability to ensure compliance. Under the newly adopted notification requirements, each equipment manufacturer will be required to notify EPA in writing and provide the following information prior to the start of the first year in which the manufacturer intends to use the flexibilities:

(1) the nonroad equipment manufacturer's name, address, and contact person's name, phone number;

(2) the allowance program that the nonroad equipment manufacturer intends to use by power category;

(3) the calendar years in which the nonroad equipment manufacturer intends to use the exception;

(4) an estimation of the number of engines to be exempted under the transition provisions by power category;

(5) the name and address of the engine manufacturer from whom the equipment manufacturer intends to obtain exempted engines; and

(6) identification of the equipment manufacturer's prior use of Tier 2/3 transition provisions.

Engine manufacturers supported the new notification requirements for equipment manufacturers. One equipment company, however, commented that the notification requirements are of minimal value and should be deleted. We disagree and continue to believe the new notification requirements will greatly enhance our ability to ensure compliance with the flexibility provisions. Given the limited information that must be provided by equipment manufacturers, we do not expect that the notifications will require any significant effort to pull the information together and submit to EPA.

EPA had requested comment on whether the notification provisions should also apply to the current Tier 2/Tier 3 transition program, and if so, how these provisions should be phased in for equipment manufacturers using the current Tier 2/Tier 3 transition provisions. We did not receive any comments on this issue. However, consistent with our approach to several other Tier 4 requirements that we were considering applying to the Tier 2/Tier 3 transition program, we are not adopting such notification requirements for equipment manufacturers for the current Tier 2/Tier 3 program.

c. Reporting Requirements for Engine and Equipment Manufacturers

As with the current program, engine manufacturers who participate in the Tier 4 program will be required to submit information each year on the number of such engines produced and to whom the engines are provided. The purpose of these submittals is to help EPA monitor compliance with the program and prevent abuse of the program.

We are adopting new reporting requirement for equipment manufacturers participating in the Tier 4 equipment manufacturer transition provisions. With today's action, equipment manufacturers participating in the program will be required to submit an annual written report to EPA that calculates its annual number of exempted engines under the transition provisions by power category in the previous year. Equipment manufacturers using the percent of production allowance, will also have to calculate the percent of production the exempted engines represented for the appropriate year. Each report will include a cumulative calculation (both total number

and, if appropriate, the percent of production) for all years the equipment manufacturer is using the transition provisions for each of the Tier 4 power categories. In order to ease the reporting burden on equipment manufacturers, EPA intends to work with the manufacturers to develop an electronic means for submitting information to EPA.

EPA had requested comment on whether these new reporting requirements for equipment manufacturers should also apply to the current Tier 2/Tier 3 transition program, and if so, how these provisions should be phased in for equipment manufacturers using the current Tier 2/Tier 3 transition provisions. We did not receive any comments on this issue. However, consistent with our approach to several other Tier 4 requirements that we were considering applying to the Tier 2/Tier 3 transition program, we are not adopting reporting requirements for equipment manufacturers for the current Tier 2/Tier 3 program.

d. Labeling Requirements for Engine and Equipment Manufacturers

Engine manufacturers are currently required to label their certified engines with a label that contains a variety of information. Under today's action, as proposed, we are adopting requirements that engine manufacturers be required to identify on the engine label if the engine is exempted under the Tier 4 transition program. In addition, and also as proposed, equipment manufacturers will be required to apply a label to the engine or piece of equipment that identifies the equipment as using an engine produced under the Tier 4 transition program for equipment manufacturers.

Engine manufacturers were opposed to the new labeling requirements. We believe these new labeling requirements will allow EPA to easily identify the exempted engines and equipment, verify which equipment manufacturers are using these exceptions, and more easily monitor compliance with the transition provisions. Labeling of the equipment should also help U.S. Customs to quickly identify equipment being imported using the exemptions for equipment manufacturers.

4. What are the requirements associated with use of transition provisions for equipment produced by foreign manufacturers?

Under the current regulations in 40 CFR 89.2, importers are treated as equipment manufacturers and are each allowed the full allowance under the transition provisions in 40 CFR 89.102(d). Therefore, under the current provisions, importers of equipment from a foreign equipment manufacturer could as a group import more excepted equipment from that foreign manufacturer than 80% of that manufacturer's production for the U.S. market (i.e., more than the percent-of-production), or more than the small-volume allowance. Therefore, the current regulation creates a potentially significant adverse environmental impact. EPA did not intend this outcome, and does not believe it is needed to provide reasonable lead time to foreign equipment manufacturers. EPA thus proposed to change the current regulations to eliminate this disparity.

As noted earlier, with today's action, only those nonroad equipment manufacturers that install engines and have primary responsibility for designing and manufacturing equipment will qualify for the allowances or other relief provided under the Tier 4 transition provisions. Foreign equipment manufacturers who comply with the compliance related provisions discussed below will receive the same allowances and other transition provisions as domestic manufacturers. Foreign equipment manufacturers who do not comply with these compliance related provisions will not receive allowances. Importers that have little involvement in the manufacturing and assembling of the equipment will not receive any allowances or other transition relief directly, but can import exempt equipment if it is covered by an allowance or transition provision associated with a foreign equipment manufacturer. These provisions allow the transition allowances and other provisions to be used by foreign equipment manufacturers in the same way as domestic equipment manufacturers, while avoiding the potential for importers using unnecessary allowances.

Under today's action, a foreign equipment manufacturer includes any equipment manufacturer that produces equipment outside of the United States that is eventually sold in the United States. All foreign nonroad equipment manufacturers wishing to use the transition provisions will have to comply with all requirements of the regulation discussed above including: notification, recordkeeping, reporting and labeling. Along with the equipment manufacturer's notification described earlier, a foreign nonroad equipment manufacturer will have to comply with various compliance related provisions similar to those adopted in several fuel regulations relating to foreign refiners.[68] As part of the notification, the foreign nonroad equipment manufacturer will have to:

1) Agree to provide EPA with full, complete and immediate access to conduct inspections and audits;
2) Name an agent in the District of Columbia for service of process;
3) Agree that any enforcement action related to these provisions will be governed by the Clean Air Act;
4) Submit to the substantive and procedural laws of the United States;
5) Agree to additional jurisdictional provisions;
6) Agree that the foreign nonroad equipment manufacturer will not seek to detain or to impose civil or criminal remedies against EPA inspectors or auditors for actions performed within the scope of EPA employment related to the provisions of this program;
7) Agree that the foreign nonroad equipment manufacturer becomes subject to the full operation of the administrative and judicial enforcement powers and provisions of the United States without limitation based on sovereign immunity; and
8) Submit all reports or other documents in the English language, or include an English language translation.

[68] See, for example, 40 CFR 80.410 concerning provisions for foreign refiners with individual gasoline sulfur baselines.

In addition to these requirements, we are adopting a new provision for foreign equipment manufacturers that participate in the transition program to comply with a bond requirement for engines imported into the U.S. We believe the bond requirements are an important tool to ensure that foreign equipment manufacturers are subject to the same level of enforcement as domestic equipment manufacturers. Furthermore, we believe that a bonding requirement for the foreign equipment manufacturer is an important enforcement tool in order to ensure that EPA has the ability to collect any judgements assessed against a foreign equipment manufacturer for violations of these transition provisions.

Under the bond program adopted today, a participating foreign equipment manufacturer will have to obtain annually a bond in the proper amount that is payable to satisfy United States judicial judgments that results from administrative or judicial enforcement actions for conduct in violation of the Clean Air Act. The foreign equipment manufacturer will have two options for complying with the bonding requirement. The foreign equipment manufacturer can:

1) Obtain a bond in the proper amount from a third-party surety agent that is cited in the U.S. Department of Treasury Circular 570, "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies"; or

2) Obtain an EPA waiver from the bonding requirement, if the foreign equipment manufacturer can show that it has assets of an appropriate value in the United States.

EPA expects the second bond option to address instances where an equipment manufacturer produces equipment outside the United States containing flexibility engines, but also has facilities (and thus significant assets) inside the United States. Under this second option, such a manufacturer can apply to the EPA for a waiver of the bonding requirement.

Because EPA's concerns of compliance will relate to the nature and tier of engines used in the transition equipment, we believe the bond value should be related to the value of the engine used. Therefore, we are adopting requirements that the bond be set at a level designed to represent approximately 10% of the cost of the engine for each piece of transition equipment produced for import into the United States under this program. So that manufacturers have certainty regarding the bond amounts and so that there isn't a need for extensive data submittals and evaluation between EPA and the manufacturer, the rule specifies the bond value for each imported engine based on the estimated average cost for a Tier 4 engine on which the bond would be based. Based on average engine cost estimates from table 6.2-5 of the final RIA, equipment using engines exempted under the transition program will require a bond in the amount shown in table III.B-3.

Table III.B-3. – Bond Value For Engines Imported Under the Tier 4 Transition Program

Power Range	Per Engine Bond Value
0<hp<25	$150
25≤hp<75	$300
75≤hp<175	$500
175≤hp<300	$1,000
300≤hp<600	$3,000
hp ≥600 hp	$8,000

Depending on the number of engines/equipment brought into the U.S. each year, the value of the bond calculated using the above values could change from year to year. Under the provisions adopted today, an importer would calculate the estimated bond amount using the values in table III.B-3 and be required to obtain a bond equal to the highest bond value estimated over the seven-year flexibility period. Because we have the authority to bring enforcement actions against a manufacturer for five years beyond the end of the program, the manufacturer would be required to maintain the bond for five years beyond the end of the flexibility period or five years after using up all of its available allowances, whichever occurs first. Finally, if a foreign equipment manufacturer's bond is used to satisfy a judgment within the seven-year flexibility period, the foreign equipment manufacturer will then be required to increase the bond to cover the amount used within 90 days of the date the bond is used.

Most comments received on this issue supported the proposed provisions. However, Ingersoll-Rand commented that EPA should clarify whether the special requirements for foreign equipment manufacturers apply to U.S.-based companies that have foreign manufacturing facilities. Ingersoll-Rand believes that such requirements should not apply because EPA appears to be concerned about abuse of the program by foreign companies that export machines into the U.S. With today's action, all equipment manufacturers who import equipment into the U.S. will be required to comply with the provisions for foreign equipment manufacturers, even if they are U.S.-based companies. Because there is a wide range of actual presence in this country for "U.S.–based" companies, EPA believes it is important that all companies importing equipment to the U.S. comply with the requirements for foreign equipment manufacturers. Neither the notification requirements described earlier for foreign equipment manufacturers nor the bonding requirements should cause any burden for companies with significant presence in this country. We would expect that only those companies with limited presence or no presence in this country will be impacted to any measurable degree because of the requirements placed on foreign equipment manufacturers.

In addition to the foreign equipment manufacturer requirements discussed above, EPA is also requiring importers of exempted equipment from a complying foreign equipment manufacturer to comply with certain provisions. EPA believes these importer provisions are essential to EPA's ability to monitor compliance with the transition provisions. Under today's action, each importer will be required to notify EPA prior to their initial importation of equipment exempted under the Tier 4 transition provisions. Importers will be required to submit their notification prior to the first calendar year in which they intend to import exempted equipment from a complying foreign equipment manufacturer under the transition provisions. The importer's notification will need to include the following information:

1) The name and address of importer (and any parent company);
2) The name and address of the manufacturers of the exempted equipment and engines the importer expects to import;
3) Number of exempted equipment the importer expects to import for each year broken down by equipment manufacturer and power category; and
4) The importer's use of the transition provisions in prior years (number of flexibility engines imported in a particular year, under what power category, and the names of the equipment and engine manufacturers).

In addition, EPA is requiring that any importer electing to import to the United States exempted equipment from a complying foreign equipment manufacturer will have to submit annual reports to EPA. The annual report will have to include the number of exempted equipment the importer actually imported to the United States in the previous calendar year; and the identification of the equipment manufacturers and engine manufacturers whose exempted equipment/engines were imported.

C. Engine and Equipment Small Business Provisions (SBREFA)

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. As EPA believed that the ultimate rule could have a significant economic impact on small businesses, we prepared a regulatory flexibility analysis as part of this rulemaking. We prepared an Initial Regulatory Flexibility Analysis (IRFA) pursuant to section 603 of the RFA which is part of the record for the NPRM, and we prepared a Final Regulatory Flexibility Analysis (FRFA) to support today's action.

Under section 609(b) of the RFA, a Small Business Advocacy Review Panel (SBAR Panel or Panel) is required to be convened prior to publication of both an IRFA and a FRFA. Section 609(b) of the RFA directs the Panel to, through outreach with small entity representatives (SERs), report on the comments of the SERs and make findings under section 603 of the RFA on

issues related to identified elements of an IRFA during the proposal stage of a rulemaking. During the development of the rulemaking, EPA is to analyze the elements of the IRFA in developing the FRFA for the final rulemaking (see section X.C of this preamble for more discussion on the elements of a FRFA). The purpose of the Panel was to gather information to identify impacts on small businesses and to develop potential regulatory options to mitigate these concerns. At the completion of the SBAR Panel process, the Panel prepared a Final Panel Report. This report includes:

- background information on the proposed rule being developed;
- information on the types of small entities that would be subject to the proposed rule;
- a description of efforts made to obtain the advice and recommendations of representatives of those small entities; and,
- a summary of the comments that had been received to date from those representatives.

The Panel report was included in the proposal's rulemaking record (and hence in the rulemaking record for this final rule), and provided the Panel and the Agency with an opportunity to identify and explore potential ways of shaping the rule to minimize the burden of the rule on small entities while achieving the rule's purposes and being consistent with Clean Air Act statutory requirements.

EPA approached this process with care and diligence. To identify representatives of small businesses for this process, we used the definitions provided by the Small Business Administration (SBA) for manufacturers of nonroad diesel engines and vehicles. The categories of small entities in the nonroad diesel sector that will potentially be affected by this rulemaking are defined in the following table:

Industry	**Defined as small entity by SBA if:**	**Major SIC Codes**
Engine manufacturers	Less than 1,000 employees	Major Group 35
Equipment manufacturers:		
- construction equipment	Less than 750 employees	Major Group 35
- industrial truck manufacturers (i.e., forklifts)	Less than 750 employees	Major Group 35
- all other nonroad equipment manufacturers	Less than 500 employees	Major Group 35

One small engine manufacturer and 5 small equipment manufacturers agreed to serve as Small Entity Representatives (SERs) throughout the SBAR Panel process for this proposal. These companies represented the nonroad market well, as the group of SERs consisted of businesses that manufacture various types of nonroad diesel equipment.

The following are the provisions recommended by the SBAR Panel. As described in section III.B above, there are other provisions that apply to all equipment manufacturers; however, the discussion in this section focuses mainly on small entities.

1. Nonroad Diesel Small Engine Manufacturers

a. Lead Time Transition Provisions for Small Business Engine Manufacturers

i. Panel Recommendations and Our Proposal

The transition provisions recommended by the SBAR Panel for engines produced or imported by small entities are listed below. For all of the provisions, the Panel recommended that small business engine manufacturers and small importers must have certified engines in model year 2002 or earlier in order to take advantage of these provisions. Each manufacturer would be limited to 2,500 units per year as this number allows for some market growth. The Panel recommended these stipulations in order to prohibit the misuse of the transition provisions as a tool to enter the nonroad diesel market or to gain unfair market position relative to other manufacturers.

Currently, certified nonroad diesel engines produced by small manufacturers all have a horsepower rating of 80 or less. At proposal, we considered both a one-step approach, and the two-step approach which we are finalizing today. Due to the structure of the standards and their timing, EPA proposed transition provisions for small business engine manufacturers which encompassed both approaches recommended by the Panel, with the inclusion of the 2,500 unit limit (as suggested by the Panel) for each manufacturer. Given the two-step structure of the final rule, we are only providing those proposed provisions related to that approach (a complete description of the provisions proposed by the Panel, and also by specific Panel members, is located in the SBAR Final Panel Report).

For a two-step approach the Panel recommended that:

- an engine manufacturer should be allowed to skip the first phase and comply on time with the second; or,
- a manufacturer could delay compliance with each phase of standards for up to three years.

We proposed the following provisions in the NPRM (based on available data, we believe that there are no small manufacturers of nonroad diesel engines above the 75-175 hp category):

With regard to PM-

- Engines under 25 hp and those between 75 and 175 hp have only one standard so the manufacturer could delay compliance with these standards for up to three years.
- For engines between 50 and 75 hp, we proposed to delay compliance for one year if the 2008 interim standards are met, with the stipulation that small business

manufacturers cannot use PM credits to meet the interim standard. However, if a small manufacturer elects the optional approach to the standard (elects to skip the interim standard), no further relief will be provided.

With regard to NO_X-

- There is no change in the level of the NO_X standard for engines under 25 hp and those between 50 and 75 hp, so we did not propose any special provisions for these categories.
- For engines in the 25-50 hp and the 75-175 hp categories we proposed a three year delay in the program consistent with the one-phase approach recommendation above.

ii. What We are Finalizing

We are finalizing all of the provisions set out above for NO_X. For PM, we are finalizing some of the proposed provisions with certain revisions, as described below. In finalizing these provisions, we considered not only the recommendations of the Panel, but also the public comments on the proposed small business engine manufacturer transition provisions. Extensions of an applicable standard also apply to all certification requirements associated with that standards (so that transient and NTE testing would not be required until expiration of the extension). Based on available data, and further conversations with manufacturers during the development of this rulemaking (documented in the administrative record), we have found no small business manufacturers of nonroad diesel engines above 175 hp.

For engines under 25 hp:

- PM- a manufacturer may elect to delay compliance with the standard for up to three years.
- NO_X- there is no change in the level of the existing NO_X standard for engines in this category, so no special provisions are being provided.

For engines in the 25-50 hp category:

- PM- manufacturers must comply with the interim standards (the Tier 4 requirements that begin in model year 2008) on time, and may elect to delay compliance with the 2013 Tier 4 requirements (0.02 g/bhp-hr PM standard) for up to three years. Due to an oversight at proposal, we did not include transition provisions for this category in the NPRM, but there is no reason to exclude them when all other small business engines are eligible for extensions. We therefore are adopting a three year extension with today's action. As engines in this category must meet the 2008 standard, we are not conditioning this three year extension on meeting this standard. (Please note the distinction between these engines and engines in the 50-75 hp power band, where we are conditioning a three-year extension on meeting the 2008 standards. The difference is that engines in the 50-75 hp category have an option of whether or not to meet those

2008 standards. We consequently have structured the small business engine extension to encourage a choice to comply with those standards.)

- NO_X- a manufacturer may elect to delay compliance with the standard for up to three years.

For engines in the 50-75 hp category:

- As proposed, EPA is adopting special provisions for these engines, reflecting the special provisions in the rules which give engine manufacturers the choice of meeting an interim standard for PM in 2008 and meeting the aftertreatment-based standard in 2013, or meeting the aftertreatment-based standard in 2012 without meeting an interim standard. A small business engine manufacturer may delay compliance with the 2013 Tier 4 requirement of 0.02 g/bhp-hr PM for up to three years provided that it complies with the interim Tier 4 requirements that begin in model year 2008 on time, without the use of credits. We proposed an extension of only one year, but this would be inconsistent with the extension period we are adopting, and which we proposed, for all of the other power categories. In addition, this provision for 50-75 hp engines is structured to encourage small business engine manufacturers to opt for early PM reductions by meeting the 2008 interim PM standard, so that an extension of three years is appropriate as an incentive. We are requiring that these engines achieve the 2008 standard without use of credits to assure that there be improvements in actual performance by engines certifying to the standard. We believe that such assurance is a necessary and reasonable balance for the three year additional lead time for meeting the aftertreatment-based standard. There were no adverse comments on conditioning the extension in this manner.

  In the alternative, a manufacturer may elect to skip the interim standard completely. However, manufacturers choosing this option will receive only one additional year for compliance with the 0.02 g/bhp-hr standard (i.e. compliance in 2013, rather than 2012). These engines would already have had eight years of lead time to prepare for the PM standard without any diversion of resources to meet an interim PM standard, so that an extension of longer than one year would not be appropriate, within the meaning of section 213 (b) of the Act. In addition, structuring the extension in this way encourages small engine manufacturers to choose to meet the 2008 interim standard for PM, furthering the objective of early PM emission reductions.
- NO_X- there is no change in the NO_X standard for engines in this category, therefore no special provisions are being provided.

For engines in the 75 to 175 hp category:

- PM- a manufacturer may elect to delay compliance with the standard for up to three years.
- NO_X- a manufacturer may elect to delay compliance with the standard for up to three years.

These provisions are also set out below in the following table (in all instances, these engines must meet the previously applicable standards as set out in §1039.104 (c):

Horsepower Category	**Provision**	
<25 hp	NO_X	No special provisions are being provided
	PM	Manufacturers may delay compliance with the standard for three years
25 - 50 hp	NO_X	Manufacturers may delay compliance with the standard for three years
	PM	Manufacturers must comply with the interim standards in 2008, and may delay compliance with the 2013 Tier 4 requirements (0.02 g/bhp-hr PM standard) for three years
50 - 75 hp	NO_X	No special provisions are being provided
	PM	Manufacturers must comply with the interim Tier 4 requirements in 2008, without the use of credits, and may elect to delay compliance with the 2013 Tier 4 requirements (0.02 g/bhp-hr PM standard) for three years -- *OR* -- Manufacturers may skip the interim standard completely, and will receive an additional year for compliance with the 0.02 g/bhp-hr PM Tier 4 standard (i.e. compliance in 2013, rather than 2012)
75 - 175 hp	NO_X	Manufacturers may delay compliance with the standard for three years
	PM	Manufacturers may delay compliance with the standard for three years

b. Hardship Provisions for Small Business Engine Manufacturers

i. Panel Recommendations and Our Proposals

The Panel recommended two types of hardship provisions for small business engine manufacturers. These provisions would allow for relief in the following cases:

- a catastrophic event, or other extreme unforseen circumstances, beyond the control of the manufacturer that could not have been avoided with reasonable discretion (i.e., fire, tornado, supplier not fulfilling contract, etc.); and
- the event where a manufacturer has taken all reasonable business, technical, and economic steps to comply but cannot.

The Panel believed that either hardship relief provision would provide lead time for up to 2 years, and that a manufacturer should have to demonstrate to EPA's satisfaction that failure to sell the noncompliant engines would jeopardize the company's solvency. EPA may also require that the manufacturer make up the lost environmental benefit.

We proposed the Panel recommendations for hardship provisions for small business engine manufacturers. While perhaps ultimately not necessary given the phase-in schedule discussed above, we stated that such provisions provide a useful safety valve in the event of unforeseen extreme hardship.

ii. What We are Finalizing

We received two comments on the provisions for small business engine manufacturers. SBA's Office of Advocacy commented that the rule would impose significant burdens on a substantial number of small entities with little corresponding environmental benefit; and further, that we should exclude smaller engines (those under 75 hp) from further regulation in order to comply with the Regulatory Flexibility Act and fulfill the requirement of reducing the burden on small engine classes. As proposed, we are not adopting standards based on performance of NO_X aftertreatment technologies for engines under 75 hp. As described in more detail in section II of this preamble, the Summary and Analysis of Comment Document, and the RIA, we have found no factual basis supporting the assertion that standards for PM for engines between 25 and 75 hp based on use of advanced aftertreatment impose costs out of relation to environmental benefit, have a disproportionate impact on small businesses, or are otherwise inappropriate. In fact, it is our finding that these standards for PM are "appropriate" within the meaning of section 213(a)(4) of the Clean Air Act, and that PM standards for these engines not based on performance of advanced aftertreatment would be inappropriate as failing to reflect standards based on available treatment for these engines (taking into account costs, noise, safety, and energy factors). We received no adverse comments from small business engine manufacturers on the proposed transition provisions for those manufacturers.[69] Accordingly, we are finalizing the small business engine manufacturer hardship provisions that we proposed in the NPRM (as recommended by the Panel). We believe that these provisions will provide adequate regulatory flexibility for these manufacturers, while remaining consistent with the requirements of section 213(a)(4) and 213 (b) of the Clean Air Act.

c. Other Small Business Engine Manufacturer Issues

i. Panel Recommendations and Our Proposals

The Panel also recommended that an ABT program be included as part of the overall rulemaking program. In addition, the Panel suggested that EPA take comment on including specific ABT provisions for small business engine manufacturers. We proposed an ABT program for all engine manufacturers, with this program retaining the basic structure of the current nonroad diesel ABT program.

[69] The one comment that we received supported the provisions proposed for small business engine manufacturers.

We did not include small business engine manufacturer-specific ABT provisions in the proposal. Discussions during the SBAR process indicated that small volume manufacturers would need extra time to comply due to cost and personnel constraints, and there is little reason to believe that small business manufacturer specific ABT provisions could create an incentive to accelerate compliance.

ii. What We are Finalizing

As discussed above in section III.B, we are finalizing an ABT program in today's action similar to that already in place for nonroad engine manufacturers. We have also made a number of changes to accommodate implementation of these new emission standards.

2. Small Nonroad Diesel Equipment Manufacturers

a. Transition Provisions for Small Business Equipment Manufacturers

i. Panel Recommendations and Our Proposals

The Panel recommended that we adopt the transition provisions described below for small business manufacturers and small business importers of nonroad diesel equipment. These transition provisions are similar to those in the Tier 2/3 rule (see 40 CFR 89.102). The recommended transition provisions were as follows:

- Percent-of-Production Allowance: Over a seven model year period, equipment manufacturers may install engines not certified to the new emission standards in an amount of equipment equivalent to 80 percent of one year's production. This is to be implemented by power category with the average determined over the period in which the flexibility is used.

- Small Volume Allowance: A manufacturer may exceed the 80 percent allowance in seven years as described above, provided that the previous Tier engine use does not exceed 700 total over seven years, and 200 in any given year. This is limited to one family per power category.
  Alternatively, the Panel recommended, at the manufacturer's choice by hp category, a program that eliminates the "single family provision" restriction with revised total and annual sales limits as shown below:
  - for categories ≤175 hp- 525 previous Tier engines (over 7 years) with an annual cap of 150 units (these engine numbers are separate for each hp category defined in the regulations)
  - for categories of > 175 hp- 350 previous Tier engines (over 7 years) with an annual cap of 100 units (these engine numbers are separate for each hp category defined in the regulations)

The Panel recommended that EPA seek comment on the total number of engines and annual cap values listed above. In contrast to the Tier 2/Tier3 rule, the SBA Office of Advocacy expected the transition to the Tier 4 technology will be more costly and technically difficult. Therefore, the small business equipment manufacturers may need more liberal flexibility allowances especially for equipment using the lower hp engines. The Panel's recommended flexibility may not adequately address the approximately 50 percent of small business equipment models where the annual sales per model is less than 300 and the fixed costs are higher. Thus, the SBA Office of Advocacy and the Office of Management and Budget (OMB) Panel members recommended that comment be sought on implementing the small volume allowance (700 engine provision) for small business equipment manufacturers without a limit on the number of engine families which could be covered in any hp category.

- Due to the changing nature of the technology as the manufacturers make the transition from Tier 2 to Tier 3 and Tier 4, the Panel recommended that the equipment manufacturers be permitted to borrow from the Tier3/Tier 4 flexibilities for use in the Tier 2/Tier 3 time frame.

- Lastly, the Panel recommended proposing a continuation of the current transition provisions, without modifications to the levels or nature of the provisions, that are available to these manufacturers.

To maximize the likelihood that the application of these provisions will result in the availability of previous Tier engines for use by the small business equipment manufacturers, the Panel recommended that - similar to the application of flexibility options that are currently in place - these provisions should be provided to all equipment manufacturers.[70]

We did in fact propose the Percent-of-Production and Small Volume Allowances listed above for all equipment manufacturers, and explicitly took the Panel report into account in making that proposal. We also requested comment on a number of additional items, some of which were proposed by the Panel (see section III.B above).

ii. What We are Finalizing

We are finalizing the Percent-of-Production and Small Volume Allowances for all equipment manufacturers, with a few changes. Some non-small equipment manufacturers commented that the small-volume provision should enable manufacturers to exempt up to 700

[70] The Panel recognized that, similar to the Tier 2/3 standards, it may be necessary to provide transition provisions for all equipment manufacturers, not just for small entities, and the Panel recommended that this be taken into account.

pieces of equipment over a seven-year period, with no engine family restriction. As explained earlier in section III.B.2.c, we are finalizing provisions that allow manufacturers to choose between two options: a) manufacturers would be allowed to exempt 700 pieces of equipment over seven years, within one engine family; or b) manufacturers using the small-volume allowance could exempt 525 machines over seven years (with a maximum of 150 in any given year) for each of the three power categories below 175 horsepower, and 350 machines over seven years (with a maximum of 100 in any given year) for the two power categories above 175 horsepower. Concurrent with the revised caps, manufacturers could exempt engines from more than one engine family under the small-volume allowance program. As explained earlier, based on sales information for small businesses, we estimated that the alternative small-volume allowance program to include lower caps and allow manufacturers to exempt more than one engine family would keep the total number of engines eligible for the allowance at roughly the same overall level as the 700-unit program. The Agency believes that these provisions will afford manufacturers the type of transition leeway recommended by the Panel. Further, these transition provisions could allow small business equipment manufacturers to postpone any redesign needed on low sales volume or difficult equipment packages, thus saving both money and strain on limited engineering staffs. Within limits, small equipment manufacturers would be able to continue to use their current engine/equipment configuration and avoid out-of-cycle equipment redesign until the allowances are exhausted or the time limit passes.

During the SBREFA Panel process, the Panel discussed the possible misuse of the transition provisions by using them as a loophole to enter the nonroad diesel equipment market or to gain unfair market position relative to other manufacturers. See 68 FR at 28481. EPA was concerned that importers of equipment from a foreign equipment manufacturer could, as a group, import more exempted equipment from that foreign manufacturer than 80 percent of that manufacturer's production for the United States market or more than the small volume allowances identified in the transition provisions. This would create a potentially significant disparity between the treatment of foreign and domestic equipment manufacturers. EPA did not intend this outcome, and did not believe it was needed to provide reasonable lead time to foreign equipment manufacturers. The Panel recognized that this was a possible problem, and believed that a requirement that small equipment manufacturers and importers must have reported equipment sales using certified engines in model year 2002 or earlier in order to be eligible to access the transition provisions was sufficient to alleviate this problem. Upon further analysis during the development of the proposal, EPA decided to limit the availability of transition provisions to entities that install engines and have primary responsibility for designing and manufacturing equipment and included such a requirement in the proposal. Id. at 28477. Therefore, a company that only imported equipment, and had no involvement in the actual manufacturing of the equipment, would be ineligible to access the transition provisions. As described in section III.B.4, we are finalizing the proposed requirements associated with the use of transition provisions by foreign importers. Therefore, we no longer believe it is necessary to have a separate requirement that small equipment manufacturers and importers have reported equipment sales using certified engines in model year 2002 or earlier, and therefore are not finalizing this redundant provision.

We are also finalizing the Panel's recommendation that equipment manufacturers be allowed to borrow from Tier 4 flexibilities in the Tier2/3 time frame. See the more extended discussion on this issue in section III.B.2.d above.

We are not finalizing the Panel recommendation of a provision allowing small manufacturers to request limited "application specific" alternative standards for equipment configurations which present unusually challenging technical issues for compliance. We do not believe that the need for such a provision has been established, and further, it could likely provide more lead time than can be justified, and undermine emission reductions which are achievable. Moreover, no participant in the SBAR process or during the public comment period offered any empirical support that such a problem even exists. Nor have such issues been demonstrated (or raised) by equipment manufacturers, small or large, in implementing the current nonroad standards. In addition, we believe that any application-specific difficulties can be accommodated by the transition provisions the Agency is proposing including ABT.

We are also finalizing two additional provisions for all equipment manufacturers that small business equipment manufacturers may take advantage of. These provisions are the Technical Hardship Provision and the Early Tier 4 Engine Incentive Program. Both provisions are discussed in greater detail in sections III.B.2.b and e above.

b. Hardship Provisions for Small Business Equipment Manufacturers

i. Panel Recommendations and Our Proposals

The Panel also recommended that two types of hardship provisions be extended to small business equipment manufacturers. These provisions would allow for relief in the following cases:

- a catastrophic event, or other extreme unforseen circumstances, beyond the control of the manufacturer that could not have been avoided with reasonable discretion (i.e., fire, tornado, supplier not fulfilling contract, etc.).

- the event where a manufacturer has taken all reasonable business, technical, and economic steps to comply but cannot. In this case relief would have to be sought before there is imminent jeopardy that a manufacturer's equipment could not be sold and a manufacturer would have to demonstrate to the Agency's satisfaction that failure to get permission to sell equipment with a previous Tier engine would create a serious economic hardship. Hardship relief of this nature cannot be sought by an 'integrated' manufacturer (one which also manufactures the engines for its equipment).

We proposed that the hardship provisions recommended by the Panel be extended to small business equipment manufacturers in addition to the transition provisions described above.

We also requested comment on the stipulation that, to be eligible for these hardship provisions (as well as the other proposed transition provisions), equipment manufacturers and importers must have reported equipment sales using certified engines in model year 2002 or earlier.

ii. What We are Finalizing

We are finalizing the Panel-recommended hardship provisions for small business equipment manufacturers (which are the same provisions that are being adopted for all equipment manufacturers).

EPA also received comment concerning the situation faced by small business equipment manufacturers using engines in the 25-50 horsepower range. The concern was raised that small businesses in this power grouping will face a greater relative burden in designing equipment for engines with aftertreatment, and that they may need additional lead time beyond that provided by the small volume allowances. EPA believes that in general the small volume allowances should provide reasonable lead time opportunity for these manufacturers, but recognizes that there may be individual cases where more lead time would be appropriate for small business manufacturers in this power category. EPA is therefore adopting a technical hardship provision similar to that adopted for the percent of production allowance. Small business manufacturers using engines in the 25-50 hp range could petition EPA to approve additional needed lead time in appropriate, individualized circumstances, based on a showing of extreme technical or engineering hardship as provided in 40 CFR 1039.625(m). EPA could approve additional small volume allowances, up to a total number of 1100 units. This total number includes the allowances that are already available under the rule without request. These additional allowances could only be used for engines in the 25-50 horsepower range, and could only be approved for qualifying small business equipment manufacturers. The limitations on the use of small volume allowances (such as when allowances may only be used within a single engine family and the annual limits) continue to apply to the standard allowances (that are available under the rule without request). Finally, any additional allowances granted under this provision would have to be used within 36 months after the transition flexibility period commences for these engines. The additional allowances would not be subject to the annual limits noted earlier but they could only be used after the maximum amount of standard allowances are used in a given year (e.g., a manufacturer using the 700 unit allowance would have to use 200 of their standard allowances for that year before they could use any of the additional allowances granted by EPA under this technical hardship provisions).

EPA recognizes that it is important to facilitate the process for small business equipment manufacturers to seek such approval, and intends to work with small manufacturers so that any transaction costs for them or for EPA can be minimized. For example, EPA could consider at one time a common request from similarly situated small business equipment manufacturers, as long as all of the necessary individual information for each applicant were provided. Given that information in such an application would still be both company- and fact-specific (and likely confidential as well), and that the criteria for relief as well as the scope of appropriate relief are

case-specific, we would necessarily evaluate and decide whether or not to approve additional small volume allowances on a company-by-company, case-by-case basis.

For a detailed description of the comments received on small business engine and equipment manufacturer issues, please refer to the Summary and Analysis of comments, which is a part of the rulemaking record (E-DOCKET number OAR-2003-0012, and legacy docket number A-2001-28). A summary of the SBREFA process is located in section X.C of this preamble.

D. Certification Fuel

It is well-established that measured emissions may be affected by the properties of the fuel used during the test. For this reason, we have historically specified allowable ranges for test fuel properties such as cetane number and sulfur content. These specifications are intended to represent most typical fuels that are commercially available in use. This helps to ensure that the emissions reductions expected from the standards occur in use as well as during emissions testing.

We are establishing all 6 provisions that we proposed related to the sulfur content of fuel used in conducting nonroad diesel engine emissions testing:

- 300-500 ppm for model year 2008 to 2010 engines,
- 7-15 ppm for 2011 and later model year engines,
- Extension through model year 2007 of the maximum 2000 ppm specification for Agency testing on pre-Tier 4 engines,
- 7-15 ppm for 2007-2010 model year engines that use sulfur-sensitive technology,
- 7-15 ppm for 2008-2010 model year engines under 75 hp,
- 300-500 ppm for some model year 2006-2007 engines at or above 100 hp.

The last 3 of these provisions are at the certifying manufacturer's option, and involve additional measures that the manufacturer must take to help ensure that the specified fuel is used in the field. The below discussion provides more detail on each of these provisions.

We received very little comment on our proposed certification fuel provisions. Detroit Diesel commented that we should set a maximum sulfur specification of 500 ppm for Tier 3 engines, which we are in fact doing beginning in model year 2008 after this fuel is introduced in the nonroad market, and optionally allowing as early as 2006, the earliest Tier 3 model year, provided manufacturers take steps to encourage the use of this fuel, as discussed below.

Because we are lowering the upper limit for in-use nonroad diesel fuel sulfur content to 500 ppm in 2007, and again to 15 ppm in 2010, we are also establishing new ranges of allowable sulfur content for testing. These are 300 to 500 ppm (by weight) for model year 2008 to 2010 engines, and 7 to 15 ppm (by weight) for 2011 and later model year engines. We believe that

these ranges best correspond to the fuels that diesel machines will potentially see in use.[71] These specifications will apply to emission testing conducted for certification, selective enforcement audits, in-use, and NTE testing, as well as any other laboratory engine testing for compliance purposes for engines in the designated model years. Any compliance testing of previous model year engines will be done with the fuels designated in our regulations for those model years. Note that, as proposed, we are allowing certification with fuel meeting the 7 to 15 ppm sulfur specification in 2010 for under 11 hp, air-cooled, hand-startable, direct injection (DI) engines certified under the optional standard provision discussed in section II.A.3.a.

It is important to note that while these specifications include the maximum sulfur level allowed for in-use fuel, we believe that it is generally appropriate to test using the most typical fuels. As for highway fuel, we expect that, under the 15 ppm maximum sulfur requirement, refineries will typically produce diesel fuel with about 7 ppm sulfur, and that the fuel could have slightly higher sulfur levels after distribution. Thus, we expect that we will use fuel having a sulfur content between 7 and 10 ppm sulfur for our emission testing. This is the same as the range we indicated will be used for heavy-duty diesel engine (HDDE) engine testing in model year 2007 and later (66 FR 5002, January 18, 2001). As with the highway fuel, should we determine that the typical in-use nonroad diesel fuel has significantly more sulfur than this, we would adjust this target upward.

We are also adopting two options for early use of the new 7 to 15 ppm sulfur diesel test fuel. The first will be available beginning in the 2007 model year for engines employing sulfur-sensitive technology. (Model year 2007 coincides approximately with the introduction of 15 ppm highway fuel.) This allowance to use the new fuel in model years before 2011 will only be available for engines which the manufacturer demonstrates will be operated in use on fuel with 15 ppm sulfur or less. Any testing that we perform on these engines will also use fuel meeting this lower sulfur specification. This optional certification fuel provision is intended to encourage the introduction of low-emission diesel technologies in the nonroad sector. These engines will be able to use the lower sulfur fuel throughout their operating life, given the early availability of this fuel under the highway program, and the assured availability of this fuel for nonroad engines by mid-2010.

Considering that our Tier 4 program will subject engines under 75 hp to new emission standards in 2008 when 15 ppm maximum sulfur fuel will be readily available from highway fuel pumps (and will enter the nonroad fuel market shortly after in 2010), we believe it is appropriate to provide a second, less proscriptive, option for use of 15 ppm sulfur certification fuel. This option will be available to any manufacturers willing to take extra steps to encourage the use of this fuel before it is required in the field. We are allowing the early use of 15 ppm certification fuel for 2008-2010 engines under 75 hp, provided the certifying manufacturer ensures that ultimate purchasers of equipment using these engines are informed that the use of fuel meeting

[71] See 66 FR 5112-5113 (January 18, 2001) where we adopted a similar approach to certification fuels for highway heavy-duty diesel engines (HDDEs).

the 15 ppm specification is recommended, and also recommends to equipment manufacturers buying these engines that labels be applied at the fuel inlet to remind users of this recommendation. This option does not apply to those 50-75 hp engines not being certified to the 0.22 g/bhp-hr PM standard, under the manufacturers' option discussed in section II.A.1.a.

We believe that there may be a very small loss of emissions benefit from any of these engines for which the operator chooses to ignore the recommendation. This is because the engine manufacturer will be designing the engine to comply with the emissions standards when tested using 15 ppm fuel, potentially resulting in slightly higher emissions when it is not operated on the 15 ppm fuel. We also believe, however, that this is more than offset overall by the encouragement this provision provides for early use of 15 ppm fuel. We are not making this option available for engine designs employing oxidation catalysts or other sulfur-sensitive exhaust emission control devices except under the more restrictive provision for early use of 15 ppm fuel described above, involving a demonstration by the manufacturer that the fuel will indeed be used. Because these devices could potentially have very high sulfur-to-sulfate conversion rates (see section II.B.4 and 5 above), and because very high-sulfur fuels will still be available to some extent, we believe that allowing this provision for these engines would risk very high PM emissions until the 15 ppm nonroad fuel is introduced. We are not making this second early 15 ppm test fuel option available for engines not subject to a new Tier 4 standard in 2008 as these engines should already be designed to meet applicable standards in earlier years without need for the 15 ppm fuel.

We are also adopting a similar provision for use of certification fuel meeting the 300-500 ppm sulfur specification before the 2008 model year. We believe certification of model year 2006 and 2007 engines being designed without the use of sulfur-sensitive technologies to meet new Tier 2 or Tier 3 emission standards taking effect in those years (2006 for engines at or above 175 hp and 2007 for 100-175 hp engines) should be able to use this fuel, provided the certifying manufacturer is willing to take measures equivalent to those discussed above to encourage the early use of this fuel (a recommendation to the ultimate purchaser to use fuel with 500 ppm maximum sulfur and a recommendation to equipment manufacturers to so label their equipment).

The widespread availability of 500 ppm sulfur highway fuel, the short time that these 2006 and 2007 engines could use higher sulfur fuels if an operator were to ignore the recommendation, and the eventual use of 15 ppm sulfur fuel in most of these engines for most of their operating lives, gives us confidence that this provision to encourage early use of lower sulfur fuel will be beneficial to the environment overall. As with the change to 300-500 ppm cert fuel for model years 2008-2010, engine manufacturers will design their engines to comply based on the test fuel specifications for certification and compliance testing. The change from a fuel specification for compliance testing that ranges up to 2000 ppm sulfur for Tier 2 and 3 engines to a specification of 500 ppm sulfur maximum could have some limited effect on the emissions control designs used on these Tier 2 and 3 engines, in that it will be slightly easier to meet the Tier 2 and 3 standards using the lower sulfur test fuel. In general, it is reasonable to set specifications of test fuel reflecting representative in-use fuels, and here the engines are expected

to be using fuel with sulfur levels of 500 ppm or lower until 2010, and 15 ppm or lower after that. In this case, any impact on expected engine emissions from this change in test fuel for Tier 2 and 3 is expected to be slight.

We note that under current regulations manufacturers are already allowed to conduct testing with certification fuel sulfur levels as low as 300 ppm. The additional provision for early use of 300-500 ppm sulfur test fuel will, however, result in any compliance testing conducted by the Agency being done with fuel meeting the 300-500 ppm specification. Likewise choice of the option for early use of 15 ppm sulfur test fuel would result in any Agency testing being done using that fuel. However, under both of these early certification fuel options involving a recommended fuel use provision, the Agency will not reject engines from in-use testing for which there is evidence or suspicion that the engine had been fueled at some time with higher sulfur fuel.

Finally, we are extending a provision adopted in the 1998 final rule (63 FR 56967, October 23, 1998). In that rule we set a 2000 ppm upper limit on the test fuel sulfur concentration for any testing to be performed by the Agency on Tier 1 engines under 50 hp and Tier 2 engines at or above 50 hp. We did not extend this provision to later model year engines at that time because we felt that more time was needed to assess trends in fuel sulfur levels for fuels used in nonroad diesels. At this time we are not aware of any additional information that would indicate that a change in this test specification is warranted. More importantly, because the fuel regulation we are adopting will make 500 ppm maximum sulfur nonroad diesel fuel available by mid-2007, Tier 3 engines at or above 50 hp (which phase in beginning in 2006) will be in the field for only 1½ years prior to the in-use introduction of 500 ppm fuel, and Tier 2 engines under 50 hp (which phase in beginning in 2004) will be in the field for at most 3½ years prior to this time. We believe it is appropriate to avoid adding the unnecessary complication of frequent multiple changes to the test fuel specification. We are therefore extending the 2000 ppm limit to testing conducted on engines until the 2008 model year when the 500 ppm maximum test fuel sulfur level takes effect as discussed above.

E. Temporary In-Use Compliance Margins

The Tier 4 standards will be challenging for diesel engine manufacturers to achieve, and will require manufacturers to develop and adapt new technologies for a large number and wide variety of engine platforms. Not only will manufacturers be responsible for ensuring that these technologies enable compliance with Tier 4 standards at the time of certification, they will also have to ensure that these technologies continue to be highly effective in a wide range of in-use environments so that their engines will comply in use when tested by EPA. Furthermore, for the first time, these nonroad diesel engines will be subject to transient emissions control requirements and to NTE standards.

However, in the early years of a program that introduces new technology, there are risks of in-use compliance problems that may not appear in the certification process or during

developmental testing. Thus, we believe that for a limited number of model years after new standards take effect it is appropriate to adjust the compliance levels for assessing in-use compliance for diesel engines equipped with high-efficiency exhaust emissions control devices. This provides assurance to the manufacturers that they will not face recall if they exceed standards by a small amount during this transition to clean technologies. This approach is very similar to that taken in the light-duty highway Tier 2 final rule (65 FR 6796, February 10, 2000) and the highway heavy-duty rule (66 FR 5113-5114, January 18, 2001), both of which involve similar approaches to introducing the new technologies. In fact, the similarities of nonroad diesel engines and expected Tier 4 control technologies to counterpart engines and technologies for heavy-duty highway diesel engines led us to model the proposed Tier 4 add-on provisions after the 2007 heavy-duty highway diesel program, with add-on levels chosen to be roughly equivalent to the levels adopted in the highway rule.

Comments on the proposal were received from engine manufacturers, requesting changes that would make the temporary in-use adjustments more closely parallel the highway requirements. Specifically, they requested: (1) providing two full model years of applicability following the completion of standards phase-in for the 75-175 hp category, as was proposed for the other power categories, (2) adjusting the NO_X threshold for applicability of the provisions to a level 8% above the split family standard, (3) adopting 3 levels of add-ons based on how many hours the test engine had been used, with cutpoints at 2000 and 3400 hours, and (4) a 25% upward adjustment to the add-on levels. We agree that these changes would result in a closer approximation to the highway program. Our goal in proposing provisions somewhat different from the highway program was to avoid unnecessary complexity. However, we believe that maintaining consistency with the highway program is a more important goal and the manufacturers' suggested changes do not overly complicate the program, and so we have decided to make these changes.

We note too that changes we are making to the Tier 4 program for engines over 750 hp necessitate other changes to the in-use add-on program for these engines as well. Specifically, these are the extension of model year applicability to 2016, two years after the final Tier 4 standards take effect, and the clarification of what PM thresholds apply for engines used in generator sets and for other engines.

Table III.E-1 shows the in-use adjustments that we will apply. These in-use add-on levels will be applied only to engines certified in the indicated model years and having FELs (or certifying to standards without FELs) at or below the specified threshold levels. These adjustments are added to the appropriate FELs (see section III.A) or, for engines certified to the standards without the use of ABT program credits, to the standards themselves, in determining the in-use compliance level for a given in-use hours accumulation on the engine being tested. Note that the PM adjustment is the same for all in-use hours accumulation. Note also that, because the standards in the regulations are expressed in g/kW-hr, the adjustments included in the regulations are set at levels that make the resulting adjusted in-use standard equivalent in

stringency to the standards in this preamble (expressed in g/bhp-hr) adjusted by the values in Table III.E-1 (also expressed in g/bhp-hr).

Note too that, as part of the certification demonstration, manufacturers will still be required to demonstrate compliance with the unadjusted Tier 4 certification standards using deteriorated emission rates. Therefore, the manufacturer will not be able to use these in-use standards as the design targets for the engine. They will need to project that most engines will meet the standards in-use without adjustment. The in-use adjustments will merely provide some assurance that they will not be forced to recall engines because of some small miscalculation of the expected deterioration rates.

Table III.E-1. – Add-on Levels Used in Determining In-use Standards

Engine Power	Model Years	NO_X		PM
		Add-On Level [a] (g/bhp-hr)	for operating hours	Add-On Level [b] (g/bhp-hr)
25 ≤ hp <75 (19 ≤ kW <56)	2013-2014	none		0.01
75 ≤ hp <175 (56 ≤ kW <130)	2012-2016	0.12	≤ 2000	0.01
		0.19	2001-3400	
		0.25	> 3400	
175 ≤ hp ≤750 (130≤ kW ≤560)	2011-2015	0.12	≤ 2000	0.01
		0.19	2001-3400	
		0.25	> 3400	
hp >750 (kW >560)	2011-2016	0.12	≤ 2000	0.01
		0.19	2001-3400	
		0.25	> 3400	

Notes:

[a] Applicable only to those engines certifying to standards or with FELs at or below 1.6 g/bhp-hr NO_X.

[b] Applicable only to those engines certifying to standards or with FELs at or below the filter-based Tier 4 PM standards (0.01 g/bhp-hr for 75-750 hp engines, 0.02 g/bhp-hr for 25-75 hp engines and for >750 hp engines in generator sets, and 0.03 g/bhp-hr for all other >750 hp engines).

F. Test Cycles

1. Transient Test

In the 1998 final rule that set new emission standards for nonroad diesel engines, EPA expressed a concern that the steady-state test cycles used to demonstrate compliance with emission standards did not adequately reflect transient operation as many nonroad engines are used in applications that are largely transient in nature and would not therefore yield adequate control of emissions in use (63 FR 56984, October 23, 1998). Although we were not prepared to adopt a transient test at that time, we announced our intention in that final rule to move forward with the development of such a test. This development progressed steadily and has resulted in the creation of the Nonroad Transient Composite (NRTC) test cycle which we are adopting in our Tier 4 nonroad diesel program. The NRTC cycle supplements the existing nonroad steady-state test requirements. Thus, most nonroad engines subject to today's Tier 4 standards will be required to certify using both of these tests.[72] The NRTC cycle captures transient emissions over much of the typical nonroad engine operating range, and thus helps to ensure effective control of all regulated pollutants. The speed and load operating schedule for EPA's NRTC test cycle is described in regulations at 40 CFR 1039.505. A detailed discussion of the transient test cycle and its derivation is contained in chapter 4.2 of the RIA for this rule.

We expect that this transient test requirement will significantly reduce real world emissions from nonroad diesel equipment. Proper transient operation testing captures engine emissions from the broad range of engine speed and load combinations that the engine may attain in-use, while the steady-state emission test characterizes emissions at the few isolated operating points that may be typical for that family of engines. Testing for transient emissions will likewise identify emissions which result from the operation of the engine, as with speed and load changes, turbocharger lag, etc.

In keeping with our goal to maximize the harmonization of emissions control programs as much as possible, we have developed this cycle in collaboration with nonroad engine manufacturers and regulatory bodies, both domestic and foreign, over the last several years.[73] Further, the NRTC cycle has been introduced as a work item for possible adoption as a potential

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[72] See EPA Dear Manufacturer Letter VPCD-98-13, "Heavy-duty Diesel Engines Controlled by Onboard Computers: Guidance on Reporting and Evaluating Auxiliary Emission Control Devices and the Defeat Device Prohibition of the Clean Air Act," October 15, 1998 and EPA Advisory Circular 24-3, "Implementation of Requirements Prohibiting Defeat Devices for On-Highway Heavy-Duty Diesel Engines." A copy of both of these documents is available in EPA Air Docket A-2001-28.

[73] Letter from Jed Mandel of the Engine Manufacturers Association to Chet France of US EPA, Office of Transportation and Air Quality, "Development of appropriate transient test cycle for variable speed land-based compression ignition non-road engines," Air Docket A-2001-28, II-B-33.

global technical regulation under the 1998 Agreement for Working Party 29 at the United Nations.[74]

EPA's nonroad transient test will apply (with one exception noted below) to a nonroad diesel engine when that engine must first show compliance with EPA's Tier 4 PM and NO_X+NMHC emissions standards which are based on the performance of the advanced post-combustion emissions control systems (e.g. catalyzed-diesel particulate filters and NO_X adsorbers). This is 2011 for engines at 175 hp - 750 hp, 2012 for 75 - 175 hp engines (2012, as well, for 50 - 75 hp engines made by a manufacturer choosing the option to not comply with the 2008 transitional PM standard.), and 2013 for engines under 75 hp. The transient test cycle will not apply to engines greater than 750 hp. Specific provision is made for engines under 25 hp for PM and under 75 hp for NO_X (which are not based on performance of advanced aftertreatment). Constant-speed, variable-load engines of any horsepower category currently certify to EPA's 5-Mode Steady State duty cycle and are not subject to transient duty cycle testing. As with current nonroad diesel standards, today's Tier 4 emission standards will apply to certification, Selective Enforcement Audits (SEAs) and to recall testing of equipment in-use for all engines subject to these standards.

Table III.F-1. – Implementation Model Year for Nonroad Transient Testing

Power Category	Transient Test Implementation Model Years
< 25 hp	2013
25 ≤ hp < 75	2013
75 ≤ hp < 175	2012
175≤ hp < 750	2011

In addition, any engines for which an engine manufacturer (see section III.M) or equipment maker (see section III.B.2.c) claims credit under the incentive program for early-introduction engines will have to be certified to that program's standards under applicable Tier 4 nonroad transient and steady-state duty cycles, e.g., NRTC, 8-mode and 5-mode steady-state cycles. In turn, any 2011 or later model year engine that uses these engine count-based credits will not need to demonstrate compliance under the NRTC cycle. Engines in any power category certified to an alternate NO_X standard are all subject to the transient test requirement, as they clearly will be substantially redesigned to achieve Tier 4 compliance, regardless of whether or not they use high-efficiency exhaust emission controls. See section II.A.1.c above.

[74] Informal Document No.2, ISO - 45th GRPE, "Proposal for a Charter for the Working Group on a New Test Protocol for Exhaust Emissions from Nonroad Mobile Machinery," Jan. 13-17, 2003, Air Docket A-2001-28, document II-A-171.

We solicited comment on whether the transient duty cycle should apply to NO_X emissions from phase-out engines (68 FR 28484, May 23, 2003) and received comment from EMA. EMA prefers that the transient cycle only be applicable to PM emission testing and not for NO_X, NMHC and CO for phase-out engine families. They believe that the application of the transient NRTC and standards could result in the need to redevelop the NO_X/NMHC/CO emission control systems used for their members' compliance with Tier 3 standards.

We essentially agree with this comment to the extent that phase-out engines do not include improvements in gaseous pollutant emission control (i.e. they remain essentially Tier 3 engines for emissions other than PM). Imposing new requirements with respect to these engines' gaseous pollutant emissions could divert resources inappropriately. The rule therefore states (in 40 CFR 1039.102 (a)(2)) that gaseous pollutant emissions from these engines are not subject to transient testing standards. This would not apply if a manufacturer declares a new NO_X+NMHC FEL for the engine family (since the manufacturer would then already be choosing to alter these engines' performance with respect to gaseous pollutant emissions).[75]

Transient testing standards do apply with respect to PM emissions from phase-out engines, however. The reason is evident: the PM standard for phase-out (and phase-in) engines is based on performance of aftertreatment, so the full complement of test cycles (NTE as well as transient testing) should apply. A consequence of this is that phase-out engines will generally be tested over the transient cycle, since they must do so with respect to PM emissions. We repeat, however, that although the engines will do transient testing, only PM (and not gaseous pollutants) is subject to the transient test standard.

In addition, manufacturers choosing to certify engines under 750 hp using alternative FEL caps during the first four years that the alternative caps are available (see section III.A.i.2 above) will not be subject to the transient or NTE standards. However, to properly account for the transient effects when calculating credits, we are requiring the FELs of such engines to be adjusted upwards by applying a Temporary Compliance Adjustment Factor (TCAF)[76]. See 40 CFR 1039.104 (g) (2).

Even though we are requiring that NRTC testing start when the PM aftertreatment-based standards take effect, one should not infer that the NRTC is directed at solely (or even primarily)

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[75] Please note that this discussion does not apply to engines certifying to the alternative NO_X phase-in standards, which engines are required to meet transient and NTE requirements for gaseous pollutants (as well as all other requirements that would apply to phase-in engines). See discussion at II.A.2.c; also please note that these engines are expressly not defined as phase-out engines in the rules; see section 1039.801 and 1039.102 (e).

[76] As noted elsewhere, the TCAFs are derived identically to the Transient Adjustment Factor used in the NONROAD emissions model.

at PM control. In fact, we believe that advanced NO_X emission controls may be even more sensitive to transient operation than PM filters, since the PM filters ordinarily operate equally effectively in all operating modes, as noted earlier. It is, however, our intent that the control of emissions during transient operation be an integral part of Tier 4 engine design considerations. We have therefore chosen to apply the transient test requirement starting with the PM filter-based Tier 4 PM standards as these standards precede or accompany the earliest Tier 4 NO_X or NMHC standards in all power categories except engines over 750 hp.

As EPA is not promulgating PM filter-based standards for engines below 25 hp in today's rulemaking, we are likewise not requiring these engines to be tested over the NRTC test cycle until model year 2013. More broadly, though we intend for transient emissions control to be an integral part of Tier 4 design considerations, we do not believe it appropriate to mandate compliance with the transient test for the engines under 50 hp which are subject to PM standards in 2008. We recognize that transient emission testing, though routine in highway engine programs, involves a fair amount of laboratory equipment and new expertise in the nonroad engine certification process. As with the transfer of advanced emission control technology itself, we believe that the transient test requirement should be implemented first for larger displacement engines. These engines are more likely to be made by manufacturers who provide engines to the on-highway market and therefore have had prior on-highway engine development and certification experience. We do not believe that the smaller engines should be the power categories first charged with implementing the new transient test, as early as 2008, especially because manufacturers of these engines do not generally make highway engines and are neither as experienced nor as well-equipped as their larger engine manufacturer counterparts at conducting transient cycle testing. However, to encourage earlier transient emission control in these engines, EPA will allow manufacturers of engines below 25 hp to submit data describing emission levels for their engines over the appropriate certification transient duty cycle beginning in model year 2008. We extend this option as well to manufacturers of 25-50 hp engines, subject to those engines meeting the Tier 4 transitional PM standard in 2008. Should a manufacturer choose to submit data in the 2008-2011 time frame, prior to required certification data submissions, that transient data will not be used for compliance enforcement.

EPA requested comment on whether engines greater than 750 hp should be subject to the transient cycle, noting concerns of technical difficulties and cost for these engines (68 FR 28484, May 23, 2003). STAPPA-ALAPCO and other agencies representing the States' interests responded to EPA that all nonroad engines should be uniformly required to test their transient emissions. Likewise, they asked that the Agency not delay implementation of this particular requirement. However, at this time, the Agency is not adopting a transient emission testing requirement for engines 750 hp and over. EPA sees the burden of transient cycle testing in these very large displacement engines as being greater than the benefit of gathering transient emission measurements from them. For example, in many instances, these engines will have multiple aspiration and exhaust systems requiring a test cell designed to accommodate multiple large flow volumes in real-time on a five Hertz, or faster, basis. New transient test requirements could require manufacturers to create new or expanded testing facilities to house, prepare and run

transient tests on these larger engines. The space requirements, i.e., "footprint," of such facilities could make building them cost-prohibitive.

Absent transient testing, these engines will still be required to certify to both steady-state and NTE test requirements. Moreover, we are modifying the certification requirements to include additional information for engines under 750 hp. For more detail on this submission, see the discussion in section III.I of this preamble and 40 CFR 1039.205(p) of the regulations.

Finally, engines in this power category are found in a relatively small proportion of the nonroad equipment population and, despite the potential for large quantities of emissions from this class of engines during operation, units equipped with these engines have likewise been noted to contribute a small proportion of total diesel nonroad engine emissions.[77] Many of these larger-displacement engines operate predominately in a constant-speed fashion with few transient excursions, as with electric power generation sets (gen sets) which make up a significant percent of these larger engines. Many of these gen sets, too, operate on an intermittent or stand-by only basis. Indeed, as explained below, such constant-speed, variable-load engines (for example, those certifying exclusively to the 5-mode steady-state cycle) of any horsepower category are not subject to the nonroad transient test cycle.

Further, the Agency does not intend at this time to require that manufacturers use partial-flow sampling systems (PFSS) to determine PM emissions from their engines for certification. A large engine manufacturer may, however, choose to submit PM data to the Agency using PFSS as an alternative test method, if that manufacturer can demonstrate test equivalency using a paired-T test and F-Test, as outlined in regulations at 40 CFR 86.1306-07.

Transient testing requires consideration of statistical parameters for verifying that test engines adequately follow the prescribed schedule of speed and load values. The regulations in 40 CFR 1065.514, table 1, detail these statistical parameters, also known as cycle performance statistics. These values are somewhat different than the comparable values for highway diesel engines to take into account the characteristics of nonroad engine operation. The values are an outgrowth of the long development process for the NRTC test cycle, itself.

2. Cold Start Transient Testing

Nonroad diesel engines typically operate in the field by starting and warming to a point of stabilized hot operation at least once in a workday. Such "cold-start" conditions may also occur at other times over the course of the workday, such as after a lunch break. We have observed that certain test engines, which generally had emission-control technologies for meeting Tier 2 or Tier 3 standards, had elevated emission levels for about 10 minutes after starting from a cold condition. The extent and duration of increased cold-start emissions will likely be affected by

[77] Memorandum from Kent Helmer to Cleophas Jackson, "Applicability EPA's NRTC cycle to Nonroad Diesel Population," Air Docket A-2001-28, document II-B-34.

changing technology for meeting Tier 4 standards, but there is no reason to believe that this effect will lessen. In fact, cold-start concerns are especially pronounced for engines with catalytic devices for controlling exhaust emissions, because many require heating to a "light-off" or peak-efficiency temperature to begin working. See, for example, RIA section 4.1.2.2 and following. EPA's highway engine and vehicle programs, which increasingly involve such catalytic devices, address this by specifying a test procedure that first measures emissions with a cold engine, then repeats the test after the engine is warmed up, weighting emission results from the two tests for a composite emission measurement.

In the proposal, we described an analytical approach that led to a weighting of 10 percent for the cold-start test and 90 percent for the hot-start test. Manufacturers pointed out that their analysis of the same data led to a weighting of about 4 percent for cold-start testing and that a high cold-start weighting would affect the feasibility of the proposed emission standards. Manufacturers also expressed a concern that there would be a significant test burden associated with cold-start testing.

Unlike steady-state tests, which always start with hot-stabilized engine operation, transient tests come closer to simulating actual in-use operation, in which engines may start operating after only a short cool-down (hot-start) or after an extended soak (cold-start). The new transient test and manufacturers' expected use of catalytic devices to meet Tier 4 emission standards make it imperative to address cold-start emissions in the measurement procedure.[78] We are therefore adopting a test procedure that requires measurement of both cold-start and hot-start emissions over the transient duty cycle, much like for highway diesel engines. We acknowledge, however, that limited data are available to establish an appropriate cold-start weighting. For this final rule, we are therefore opting to establish a cold-start weighting of 5 percent. This is based on a typical scenario of engine operation involving an overnight soak and a total of seven hours of operation over the course of a workday. Under this scenario, the 20-minute cold-start portion constitutes 5 percent of total engine operation for the day. Section II.B above addresses the feasibility of meeting the emission standards with cold-start testing. Regarding the test burden associated with cold-start testing, we believe that manufacturers will be able to take steps to minimize the burden by taking advantage of the provision that allows for forced cooling to reduce total testing time (40 CFR 1039.510(c)).

We believe the 5-percent weighting is based on a reasonable assessment of typical in-use operation and it addresses the need to design engines to control emissions under cold-start operation. We believe cold-start testing with these weighting factors will be sufficient to require manufacturers to take steps to minimize emission increases under cold-start conditions. Once manufacturers have applied technologies and strategies to minimize cold-start emissions, they will be achieving the greatest degree of emission reductions achievable under those conditions. A higher weighting factor for cold-start testing is not likely be more effective in achieving in-use

[78] Note that this discussion applies only to engines that are subject to testing with transient test procedures. For example, this excludes constant-speed engines and all engines over 750 hp.

emission control as new technologies will be expected to have resulted in significant control of emissions at engine startup.

However, given our interest in controlling emissions under cold-start conditions and the relatively small amount of information available in this area at this time, we intend to revisit the cold-start weighting factor for transient testing in the future as additional data become available. Since the composite transient test represents a combination of variable-speed and constant-speed operation, we would consider operation from both of these types of engines in evaluating the cold-start weighting. Also, we intend to apply the same cold-start weighting when we adopt a transient duty cycle specifically for engines certified only for constant-speed operation.

The planned data-collection effort will focus on characterizing cold-start operation for nonroad diesel equipment. The objective will be to reassess, and if necessary, redevelop a weighting factor that properly accounts for the degree of cold-start operation so that in-use engines effectively control emissions during these conditions. As we move forward with this investigation, other interested parties, including the State of California, will be invited to participate. We are interested in pursuing a joint effort, in consultation with other national government bodies, to ensure a robust and portable data set that will facilitate common global technical regulations. This effort will require consideration of at least the following factors:

- What types of equipment will we investigate?
- How many units of each equipment type will we instrument?
- How do we select individual models that will together provide an accurate cross-section of the type of equipment they represent?
- When will the program start and how long will it last?
- How should we define a cold-start event from the range of in-use operation?

We expect to complete our further evaluation of the cold-start weighting in the context of the 2007 Technology Review, if not sooner. In case changes to the regulation are necessary, this timing will allow enough time for manufacturers to adjust their designs as needed to meet the Tier 4 standards.

3. Constant-Speed Tests

The Agency proposed that engine manufacturers could certify constant-speed engines using EPA's Constant-Speed, Variable-Load (CSVL) transient duty cycle[79] as an alternative to certifying these engines under its NRTC test cycle. The CSVL transient cycle was developed to approximate the speed and load operating characteristics of many constant-speed nonroad diesel

[79] Two Memoranda from Kent Helmer to Cleophas Jackson, "Speed and Load Operating Schedule for the Constant Speed Variable Load (CSVL) transient test cycle," e-Docket OAR-2003-0012-0993, and "CSVL Cycle Construction," A-2001-28, II-B-50.

applications.[80] It, too, would have been subject to the cold-start requirement of nonroad transient test cycles as is the NRTC. However, after considerable discussion with and comment from engine manufacturers, equipment makers and other interested parties, the Agency has decided not to promulgate an alternative nonroad transient test cycle for constant-speed engines at this time. EMA, in its comments on the CSVL cycle, felt generally that: 1) the average load factor is much too low; 2) the frequency of the transient operations was too high; 3) the amplitudes of the transients were too great; and 4) the rates of transient load increase and response were too fast.

It was further noted that the CSVL test cycle is based solely upon the operation of a single, relatively small, naturally-aspirated arc welder engine, which EMA claims is a variable-speed type of engine certified generally on the 8-mode test cycle. Arc welders, Cummins noted, are not much like generator sets, which comprise around 50% of population of constant-speed engines and have a very different operation and test cycle than the typical portable generator set. Generator sets, DDC wrote, were built generally for a higher power capability at a single speed, many having larger, less-responsive turbochargers to achieve the higher brake mean effective pressure (BMEP). This made it difficult for these engines to shed load as quickly as the CSVL test cycle would require them to do. Commenters likewise wrote that the test cycle was costly and burdensome for equipment which, like generator sets, was only operated infrequently or when emergencies occurred. Some wrote that it would compromise generator set engine performance if manufacturers had to re-engineer their products to run over the CSVL test cycle, especially for larger BMEP engines. One commenter noted that these changes to nonroad engines would carry over to other stationary applications of these generator sets. A more extensive discussion of comments relating to the CSVL cycle may be read in the Summary and Analysis of Comment document for this rule.

Given these potential problems and the strong possibility of fixing them by 2007, the Agency has decided to defer adopting the CSVL test cycle here. Instead, EPA with all of its stakeholders in this regard will map out a process of engine testing and analysis to better characterize constant-speed equipment in-use to design the most appropriate test cycle for the largest number of constant-speed engines. EPA undertakes this process with an eye to initiating rulemaking which would lead to promulgation of a transient cycle for constant-speed engines before the Agency's 2007 Nonroad Diesel Technical Review.

EPA defines a constant-speed engine in this regard as one which is certified to constant-speed operation, in other words, an engine which may not operate at a speed outside a single, fixed reference speed set by the engine's governor. It should be clear then that any engine for which the governor doesn't strictly limit the engine speed in-use to constant-speed operation, that engine will be subject to the NRTC. Thus, if a manufacturer's engine is certified to EPA's 8-mode steady-state test, the engine would also need to certify to the NRTC, since the 8-mode test does not limit the engine's fixed operating speed. Conversely, those manufacturers who certify

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[80] Memorandum from Kent Helmer to Cleophas Jackson, "Brake-specific Emissions Impact of Nonroad Diesel Engine Testing Over the NRTC, AWQ, and AW1 duty cycles," Docket A-2001-28, # .

their engines to EPA's constant-speed steady-state test, the 5-mode test cycle are not required to have their engines certify to the NRTC.

By utilizing an inclusive, data-driven approach (see Summary and Analysis document for more detail), the Agency is allowing time to develop, and if appropriate, finalize and implement a test procedure that meets the needs of the Agency, manufacturers, and other parties in advance of the 2007 Technology Review. In fact, the Agency envisions constant speed variable load cycle generation to be completed by July 2005. This approach should allow the Agency to develop a testing program which ensures robust control in-use, is data-driven and remains globally harmonized. We expect to initiate this effort within 3 months of promulgation of this rule and to conclude the work on the new test cycle in enough time to promulgate it through rulemaking and to provide industry adequate lead time to implement it in an orderly manner. If we encounter unforeseen and unavoidable delays or complications in this process, we will consider approaches to control based on available data at the time of the 2007 Technology Review.

The Agency is adopting additional requirements, in conjunction with existing steady-state test requirements, which will help ensure that constant-speed nonroad diesel engines are subject to a rigorous program of in-use control of emissions and that diesel engine emissions will be controlled over a wide range of speed and load combinations. EPA is finalizing stringent nonroad NTE limits and related test procedures for all new nonroad diesel engines subject to the Tier 4 emissions standards beginning in 2011 which will supplement the existing steady-state five-mode test cycle for constant-speed application engines. NTE testing for transient operation will add further assurance that emissions from constant-speed engines within this class, which have a limited speed response in-use, are controlled under in-use operation. Typically, engines which are designed to a particular transient cycle will control emissions effectively under other types of transient operation not specifically included in that certification procedure. Engines that are capable of meeting emission standards on a constant-speed, variable-load cycle will have the transient-response characteristics that are appropriate for controlling emissions at higher engine loads and for less dynamic transient operation. EPA, engine manufacturers, and interested parties will, in the mean time, work to develop a more appropriate transient test for constant-speed engines. A transient test for this broad class of nonroad engines will ensure a robust level of emissions control in-use within the diverse population of constant-speed engines and equipment.

4. Steady-State Tests

Recognizing the variety of both power classes and work applications to be found within the nonroad equipment and engine population, and as proposed, EPA is retaining current Federal steady-state test procedures for nonroad engines. (Manufacturers are thus required to meet emission standards under steady-state conditions, in addition to meeting emission standards under the transient test cycle, whenever the transient test cycle applies.) This requirement, like NTE emission testing, is one of two tests which apply to every Tier 4 engine. Table III-2 below

sets out the particular steady-state duty cycle applicable to each of the following categories: 1) nonroad engines 25 hp and greater; 2) nonroad engines less than 25 hp; and 3) nonroad engines having constant-speed, variable-load applications, (e.g., gen sets). The steady-state cycles remain, respectively, the 8-mode cycle, the 6-mode cycle and the 5-mode cycle.[81]

Steady-state test cycles are needed so that testing for certification will reflect the broad range of operating conditions experienced by these engines. A steady-state test cycle represents an important type of modern engine operation, in power and speed ranges that are typical in-use. The mid-to-high speeds and loads represented by present steady-state testing requirements are the speeds and loads at which these engines are designed to operate for extended periods for maximum efficiency and durability. Details concerning the three steady-state procedures for nonroad engines and equipment are found in regulations at 40 CFR 1039.505 and in Appendices I-III to 40 CFR part 1039.

Manufacturers will perform each steady-state test following all applicable test procedures in the regulations at 40 CFR part 1039, e.g., procedures for engine warm-up and exhaust emissions measurement. The testing must be conducted with all emission-related engine control variables in the maximum NO_X-producing condition which could be encountered for a 30 second or longer averaging period at a given test point. Table III.F-2 below summarizes the steady-state testing requirements by individual engine power categories.

[81] These three steady-state test cycles are similar to test cycles found in the International Standard ISO 8178-4:1996 (E) and remain consistent with the existing 40 CFR part 89 steady-state duty cycles.

Table III.F-2. – Summary of Steady-State Test Requirements

Nonroad Engine Power Classes	Steady-State Testing Requirements		
	8-Mode Cycle (C1weighting)	6-Mode Cycle (G3 weighting)	5-Mode Cycle (D2 weighting)
hp < 25 (kW < 19)	applies [a]	applies [a]	applies [b]
25 ≤ hp < 75 (19 ≤ kW < 56)	applies	NA [c]	applies [b]
75 ≤ hp < 175 (56 ≤ kW < 130)	applies	NA [c]	applies [b]
175 ≤ hp ≤ 750 (130 ≤ kW ≤ 560)	applies	NA [c]	applies [b]
hp > 750 (kW > 560)	applies	NA [c]	applies [b]

Notes:

[a] Manufacturers may use either of these tests for this class of engines.

[b] For constant, or nearly constant, speed engines and equipment with variable, or intermittent, load.

[c] Testing procedures not applicable to this class of engines.

Nonroad engine manufacturers[82], have called for steady-state testing which would collect emissions continuously "in a pseudo-transient manner," proposing in effect, one-filter PM collections during a steady-state duty cycle. In response to these and other manufacturer concerns for emission variability during certification testing due to unanticipated emission control system regeneration between steady-state test modes, the Agency[83] has adopted, in its 40 CFR 1065.515 regulations, the concept of modifying EPA's 40 CFR part 89 steady-state engine certification duty cycles. The section describes ramped "modal" steady-state certification tests which would link the modes of a steady-state test together for the purpose of collecting a continuous stream of engine emissions. These tests provide for operating an engine at all of the modes specified in the present steady-state nonroad test cycles but without the breaks in emission collection required by switching between modes, stabilizing engine operation, and collecting emissions at that next operating mode. Since a ramped modal cycle (RMC) test cycle may more reliably and consistently report engine emissions from particulate trap and other emission control hardware-equipped nonroad engines than the comparable steady-state duty cycle from which it was derived, the Agency is providing the option of using these RMC versions of its steady-state engine duty cycles for nonroad diesel engine certification testing in lieu of the otherwise applicable steady-state cycles. Details on the procedures may be found in chapter 4.2 of the RIA for this rule and at regulations at 40 CFR 1039.505 and Appendix I of part 1039.

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[82] Letter from EMA (Engine Manufacturers Association) to EPA Air Docket A-2001-28, IV-D-402, pp 64.

[83] Memorandum and summary of technical discussions (including Appendix "A" text) in the e-Docket submission, OAR-2003-0012-0028, to EPA's Air Docket.

The optional RMC duty cycles do not represent a relaxation in stringency of emission testing nor are they an unreasonable increase in the emission test burden of diesel engine manufacturers. Rather, the RMC versions of EPA's steady-state test cycles allow for more consistent and predictable emission testing of emission control system hardware-equipped diesel engines. Eliminating the “downtime” between modes for the emission collection equipment allows sampling of emissions to be done on a composite basis for the whole test as opposed to sampling emissions mode-by-mode. The RMC versions of these tests simply create a negligible transition period 20 seconds long connecting each mode and collects emissions during these brief transitions, as well as collecting emissions during the running of each test's discrete operating modes. The continuous emission sampling allows regeneration events from engine emission control hardware to be captured more reliably and repeatably. By running emission testing without breaks and over the same engine duty schedule for each repetition of a RMC test, regeneration within the engine's emission control hardware should become almost a predictable event. The longer sampling times of RMCs, while creating an identical weighting of each mode's emissions, also help to avoid collecting a minuscule, possibly unreliably measured, amount of sample over the course of any single operating mode. PM emissions, for example, can be collected and measured more precisely under these test conditions as either batch or continuous samples. The opportunities for loss of emissions during sampling and storage due to sample retention by equipment at shut-down between modes or by filter handling and weighing are greatly reduced. As well, running a “steady-state” test on a continuous basis allows cycle performance statistics to be applied to RMC emission tests (see 40 CFR, part 39). Manufacturers are familiar with test cycles run with a set of statistical engine duty cycle performance "targets". Further, their test runs will be subject to less test cell "tuning", modifying control strategies using repeat testing runs to fit the emission test cycle and the dynamometer to operate a particular engine. Finally, statistical targets serve to increase repeatability and reduce variability of engine operating parameters and emission test results on a test-to-test basis.

Transport refrigeration unit (TRU) engines, a specific application of a steady-state operation engine (68 FR 28485, May 23, 2003), will be subject to both steady-state and NTE standards based on any normal operation that these engines would experience in the field. To that end, EPA has adopted a four-mode steady-state test cycle designed specifically for engines used in TRU applications which may be used by the manufacturer in lieu of normal steady-state testing. Commenters to the rule agreed that a TRU test cycle would be more representative of refrigeration unit operation than the nonroad cycles currently available to manufacturers of TRU engines, but some took issue with EPA’s usage restrictions in paragraphs (d)(2), (e)(2), and (e)(3) of regulations proposed at 40 CFR part 1039 subpart G. In response, the final rule allows manufacturers to test their engines under a broad definition of intermediate test speed. The definition covers the 60-75 % range of engine rpm at the specified test cycle engine load points, as defined in 40 CFR, 89.2. This will enable an engine manufacturer to more closely match the TRU cycle to the operation of their engines in-use. Further, the engine is allowed to exhibit no more than 2% variation in transient operation (speed or torque change) around the four operating

modes defined under this test cycle. The provisions to address load set point drift are discussed in detail in the RIA chapter 4.3.2 and in regulations at 40 CFR part 1039 subpart G.

In choosing to certify their engine as a TRU engine, manufacturers will need to state on the engine emission control label that the engine will only be used in a TRU application and records must be kept on the delivery destination(s) for their engines. Manufacturers of these engines may petition EPA at certification for a waiver of the requirement to provide smoke emission data for their constant-torque engines. A more detailed discussion of the TRU associated provisions is contained in chapter 4.2 of the RIA. It should be noted that an RMC version of the steady state TRU duty cycle is provided in Table 2 of 40 CFR part 1039 subpart G.

G. Other Test Procedure Issues

This section contains further detail and explanation regarding several related nonroad diesel engine emissions test and measurement provisions. The test procedures are specified in 40 CFR part 1065 and part 1039 subpart F. Part 1065 contains general test procedure requirements and part 1039 contains the provisions that are specific to CI nonroad engines, such as test cycles. The changes described here will not significantly affect the stringency of the standards. While some of the changes being made may appear to increase the stringency of the standards when considered by themselves, others would appear to have the opposite effect. When considered together, however, they will result in more repeatable and less subjective testing that is equivalent to the existing procedures with respect to stringency.

1. Smoke Testing

To control smoke emissions, we are requiring in this final rule that the current smoke standards and procedures will continue to apply to certain engines. We proposed to change these smoke standards and procedures, based on recent developments toward an established international protocol that was designed to allow a straightforward method to test engines in the field (68 FR 28486, May 23, 2003). We have chosen not to adopt the proposed approach, mainly because it is becoming increasingly clear that ongoing development of in-use testing equipment will allow direct measurement of PM emissions in the field. We believe this will provide the best long-term control of both PM emissions. Controlling smoke is in some ways independent of PM, but the interest in developing an in-use smoke test was primarily as a means of providing a secondary indicator of high in-use PM emissions from these engines. Direct PM measurement removes much of the advantage of in-use smoke measurements. Relying on the existing smoke test also addresses concerns raised by manufacturers that the effort to comply with the new smoke requirements would be a large testing and development burden with little air-quality benefit. We believe that aftertreatment-based Tier 4 PM standards will control smoke emissions as well as improved smoke testing standards and procedures. Engines below 19 kilowatts (kW) will generally not have particulate filters, but most of these are constant-speed engines and are therefore not subject to smoke standards, as described below.

We are continuing the established policy of exempting constant-speed engines and single-cylinder engines from smoke standards. We do not believe that constant-speed engines undergo the kind of acceleration or lugging events that occur during this smoke test procedure, so it would not be appropriate for these engines to be subject to smoke standards. We exempt single-cylinder engines for a different reason. These engines, which very often provide power for generator sets and other constant-speed applications, but may in some cases experience accelerations, the nature of single-cylinder engine operation makes it difficult to get a valid smoke emission measurement. Single-cylinder engines generally have discrete puffs of smoke, rather than a stable emission stream for measuring smoke values. We believe it is not appropriate to use such erratic measurements to evaluate an engine's emission performance. As a result, we will not require single-cylinder engines to meet our smoke standards until we find a test method that takes this into account.

Also, as described in the proposed rule, we are exempting from smoke emission standards any engines that are certified to PM emission standards or FELs at or below 0.07 g/kW-hr. We believe any engine that has such low PM emissions will have inherently low smoke emissions. No commenters disagreed with this position.

2. Maximum Test Speed

We are changing how test cycles are specified. As proposed, we are applying the existing definition of maximum test speed in 40 CFR part 1065 to nonroad CI engines. This definition of maximum test speed is the single point on an engine's normalized maximum power versus speed curve that lies farthest away from the zero-power, zero-speed point. This is intended to ensure that the maximum speed of the test is representative of actual engine operating characteristics and is not improperly used to influence the parameters under which their engines are certified. In establishing this definition of maximum test speed, it was our intent to specify the highest speed at which the engine is likely to be operated in use. Under normal circumstances this maximum test speed should be close to the speed at which peak power is achieved. However, in past discussions, some manufacturers have indicated that it is possible for the maximum test speed to be unrepresentative of in-use operation. Since we were aware of this potential during the original development of this definition, we included provisions to address issues such as these. Part 1065 allows EPA to modify test procedures in situations where the specified test procedures would otherwise be unrepresentative of in-use operation. Thus, in cases in which the definition of maximum test speed resulted in an engine speed that was not expected to occur with in-use engines, we would work with the manufacturers to determine the maximum speed that would be expected to occur in-use (see regulations at 40 CFR 1065.10 (c)).

3. Improvements to the Test Procedures

As we proposed, we are making changes to the test procedures to improve the precision of emission measurements. These changes address the potential effect of measurement precision on the feasibility of the standards. It is important to note that these changes are not intended to

bias results high or low, but only to improve the precision of the measurements. Based on our experience with these modified test procedures, and our discussions with manufacturers about their experiences, we are confident that these changes will not affect the stringency of the standards. These changes are summarized briefly here. The rationale for the changes are discussed in detail elsewhere. The changes affecting Constant Volume Sampling (CVS) and PM testing are discussed in a memo to the docket (Air Docket A-99-06, IV-B-11), which was originally submitted in support of the recent highway heavy-duty diesel engine rule (66 FR 5001, January 18, 2001).

In general, we are applying the highway heavy-duty engine test procedures to nonroad CI engines in this rulemaking. Many of the specific changes being adopted are to the PM sampling procedures. The PM procedures are the procedures finalized as part of the highway heavy-duty diesel engine rule (66 FR 5001, January 18, 2001). These include changes to the type of PM filters that are used and improvements in how PM filters are weighed before and after emission measurements, including requirements for more precise microbalances.

It is also worth noting that we intend to make additional improvements to the test procedures in a separate rulemaking that will be proposed later this year to incorporate the latest measurement technologies. Many of the improvements being considered were discussed in the previously-mentioned memo to the docket (Air Docket A-99-06, IV-B-11). We recognize the importance of these improvements for use in testing by nonroad diesel engine manufacturers and EPA. However, since we expect that the changes would also apply to many nonroad spark-ignition engine manufacturers, it is appropriate to conduct a separate notice and comment rulemaking for all affected parties. We remain committed to incorporating appropriate additional improvements to the test procedures. We have placed into the docket a draft revised version of part 1065 that represents our current thinking on appropriate testing regulations.

H. Engine Power

Currently, rated power and power rating are undefined, and we are concerned that this makes the applicability of the standards too subjective and confusing. One manufacturer may choose to define rated power as the maximum measured power output, while another may define it as the maximum measured power at a specific engine speed. Using this second approach, an engine's rated power may be somewhat less than the true maximum power output of the engine. Given the importance of engine power in defining which standards an engine must meet and when, we believe that it is critical that a singular power value be determined objectively according to a specific regulatory definition.

To address this, we proposed to add a definition of “maximum engine power” to the regulations. This term was to be used instead of previously undefined terms such as “rated power” or “power rating” to specify the applicability of the standards. The addition of this definition was intended to allow for more objective applicability of the standards. More specifically, we proposed that:

Maximum engine power means the measured maximum brake power output of an engine. The maximum engine power of an engine configuration is the average maximum engine power of the engines within the configuration. The maximum engine power of an engine family is the highest maximum engine power of the engines within the family.

During the comment period, manufacturers opposed the proposed definition. (We received no other comments on this issue.) The manufacturers correctly pointed out that they cannot know the average actual power of production engines when they certify an engine family, because certification typically occurs before production begins. Therefore the definition of "maximum engine power" being finalized today relies primarily upon the manufacturer's design specifications and the maximum torque curve that the manufacturer expects to represent the actual production engines. This provision is specified in a new section 40 CFR 1039.140. Under this approach the manufacturer would take the torque curve that is projected for an engine configuration, based on the manufacturer's design and production specifications, and convert it into a "nominal power curve" that would relate the maximum power that would be expected to engine speed when a production engine is mapped according our specified mapping procedures. The maximum engine power is being defined as the maximum power point on that nominal power curve.

Manufacturers will be required to report the maximum engine power of each configuration in their applications for certification. As with other engine parameters, manufacturers will be required to ensure that the engines that they produce under the certificate have maximum engine power consistent with those described in their applications. However, since we recognize that variability is a normal part of engine production, we will not require that all production engines have exactly the power specified in the application. Instead, we will only require that the power specified in the application be within the normal range of powers of the production engines. Typically, we would expect the specified power to be within one standard deviation of the mean power of the production engines. If a manufacturer determines that the specified power is outside of the normal range, we may require the manufacturer to change the settings of the engines being produced and/or amend the application for certification. In deciding whether to require such amendment, we would consider the degree to which the specified power differed from the production engines, the normal power variability for those engines, whether the engine used or generated emission credits, and whether the error affected which standards applied to the engine.

The preceding discussion presumes that each manufacturer will develop its production processes to produce the engines described in the application. If a manufacturer were to intentionally produce engines different than those described in the application, we would consider the application to be fraudulent, and could void the certificate ab initio for those engines. For example, for engines that use emission credits, this could occur if a manufacturer deliberately biased its production variability so that the engines have higher average power than described in the application. If we voided the certificate for those engines the manufacturer would be subject to large fines and any other appropriate enforcement provisions for each engine.

Finally, in light of some of the comments that we received, it is worth clarifying that the maximum engine power will not be used during engine testing. It is only used to define power categories and calculate ABT emission credits.

I. Auxiliary Emission Control Devices and Defeat Devices

Existing nonroad regulations prohibit the use of a defeat device (see 40 CFR 89.107) in nonroad diesel engines. The defeat device prohibition is intended to ensure that engine manufacturers do not use auxiliary emission control devices (AECD) which sense engine operation in a regulatory test procedure and as a result reduce the emission control effectiveness of that procedure.[84] In today's notice we are supplementing existing nonroad test procedures with a transient engine test cycle and NTE emission standards with associated test requirements. As such, the Agency believes that a clarification of the existing nonroad diesel engine regulations regarding defeat devices is required in light of these additional emission test requirements. The defeat device prohibition makes it clear that AECDs which reduce the effectiveness of the emission control system are defeat devices, unless one of several conditions is met. One of these conditions is that an AECD which operates under conditions "included in the test procedure" is not a defeat device.[85] While the existing defeat device definition does contain the term "test procedure," and therefore should be interpreted as including the supplemental testing requirements, we want to make it clear that both the supplemental transient test cycle and NTE emission test procedures are included within the defeat device regulations as conditions under which an operational AECD will not be considered a defeat device. Therefore, we are clarifying the defeat device regulations by specifying the appropriate test procedures (i.e., the existing steady-state procedures and the supplemental tests). We are clarifying the engine manufacturers certification reporting requirements with respect to the description of AECDs. Under the previous nonroad engine regulations, manufacturers are required to provide a generalized description of how the emissions control system operates and a "detailed" description of each AECD installed on the engine (see 40 CFR 89.115(d)(2)). This change clarifies what is meant by "detailed."

For engines rated above 750 horsepower, the expanded interpretation of "included in the test cycle" extends only to the NTE because we are not requiring these engine to be tested over

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[84] Auxiliary emission control device is defined at 40 CFR 89.2 as " any element of design that senses temperature, vehicle speed, engine RPM, transmission gear, or any other parameter for the purpose of activating, modulating, delaying or deactivating the operation of any part of the emission control system."

[85] 40 CFR 89.107(b)(1) states "Defeat device includes any auxiliary emission control device (AECD) that reduces the effectiveness of the emission control system under conditions which may reasonably be expected to be encountered in normal operation and use unless such conditions are included in the test procedure."

the supplemental transient test cycle. Transient emissions control strategies that are substantially included in the NTE will be considered to comply with the defeat device criteria. For instances where transient emissions control strategies are not well represented over the official test requirements, we will rely on the defeat device provisions to ensure appropriate transient off-cycle emissions control. The defeat device provisions restrict the ability of manufacturers to reduce the level of emissions control during transient operation compared to that employed over the steady state cycle. In order to evaluate transient emissions control strategies for compliance with the defeat device provisions, we are requiring manufacturers to submit information which indicates how transient emissions are controlled during normal operation and use. Information that would adequately fulfill this requirement includes but is not limited to:

A. Emissions data gathered with portable emissions measurement systems from in-service engines operating over a broad range of typical transient conditions;
B. Emissions data generated under laboratory conditions representing a broad range of typical transient operation;
C. Transient test cycle results from certified engines rated at or below 750 horsepower which share nearly identical transient emissions control strategies;
D. Base emissions control maps along with an explanation for differences in control between portions of the map substantially included in the steady-state test cycle and that which is predominately associated with transient operation;[86]
E. A comparative analysis of the base emissions control maps from certified engines rated at or below 750 horsepower and those rated over 750 horsepower.

We will use this information to determine the degree to which the design and effectiveness of the transient emissions control system compares to the control demonstrated over the steady-state cycle as well as the transient control used for certified engines at or below 750 horsepower where compliance over the transient cycle is required.

A thorough disclosure of the presence and purpose of AECDs is essential in allowing EPA to evaluate the AECD and determine whether it represents a defeat device. Clearly, any AECD which is not fully identified in the manufacturer's application for certification cannot be appropriately evaluated by EPA and therefore cannot be determined to be acceptable by EPA. Our clarifications to the certification application requirements include additional detail specific to those AECDs which the manufacturer believes are necessary to protect the engine or the equipment in which it is installed against damage or accident ("engine protection" AECDs). While the definition of a defeat device allows as an exception strategies needed to protect the engine and equipment against damage or accident, we intend to continue our policy of closely reviewing the use of this exception. In evaluating whether a reduction in emissions control effectiveness is needed for engine protection, EPA will closely evaluate the actual technology employed on the engine family, as well as the use and availability of other emission control

[86] Base emissions control maps describe the modulation of an emissions control parameter as a function of changing engine speed and torque.

technologies across the industry, taking into consideration how widespread the use is, including its use in similar engines and similar equipment. While we have specified additional information related to engine protection AECDs in the regulations, we reserve the right to request additional information on a case-by-case basis as necessary.

In the last several years, EPA has issued extensive guidance on the disclosure of AECDs for both highway and nonroad diesel engine manufactures. These provisions do not impose any new certification burden on engine manufacturers, rather, it clarifies the existing certification application regulations by specifying what type of information manufacturers must submit regarding AECDs.

Finally, we take this opportunity to emphasize that the information submitted must be specific to each engine family. The practice of describing AECDs in a "common" section, wherein the strategies are described in general for all the manufacturer's engines, is acceptable as long as each engine family's application contains specific references to the AECDs in the common section which clearly indicate which AECDs are present on that engine family, and the application contains specific calibration information for that engine family's AECDs. The regulatory requirements can be found at 40 CFR 89.115(d)(2) in today's notice.

J. Not-To-Exceed Requirements

In today's action we are finalizing not-to-exceed (NTE) emission standards for all new nonroad diesel engines subject to the Tier 4 emissions standards beginning in 2011. These NTE standards and requirements are largely identical to the NTE provisions we proposed, except as noted below.

The NTE standards and test procedures are being finalized to help ensure that nonroad diesel emissions are controlled over the wide range of speed and load combinations commonly experienced in-use. EPA has similar NTE standards for highway heavy-duty diesel engines, compression ignition marine engines, and nonroad spark-ignition engines. The NTE requirements supplement the existing steady-state test as well as the new transient test which is also being finalized today.

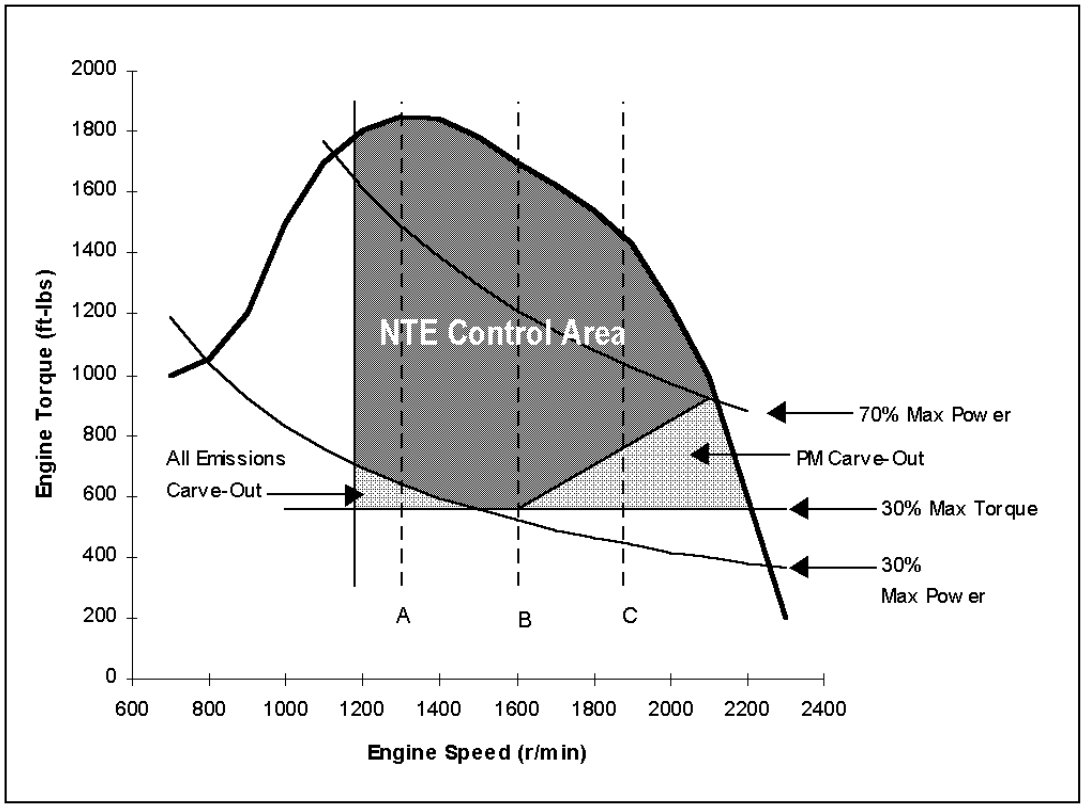
The NTE standards and test procedures which we proposed, and which we are finalizing, are derived from similar NTE standards and test procedures which EPA adopted for highway heavy-duty diesel engines. In the proposal, we requested comment on an alternative NTE test procedure approach (see 68 FR 28369, May 23, 2003). As discussed in the proposal, the two NTE approaches would result in the same overall level of emission control, but the implementation of each approach from an in-use measurement and data gathering perspective are quite different. We have decided not to finalize this alternative approach. This decision is based primarily on our belief that nonroad engine manufacturers will more easily transfer the knowledge and experience gained from the highway NTE implementation (which begins in 2007) to the nonroad program if the two programs have similar requirements. For additional

discussion regarding our decision to not finalize the alternative approach, please see the Summary and Analysis of Comments.

The NTE requirements establish an area (the "NTE zone" or "NTE control area") under the torque curve of an engine where emissions must not exceed a specified value for any of the regulated pollutants.[87] An illustrative NTE zone is shown in Figure III.J-1.

Figure III.J-1: Example NTE Control Area

Note: PM Carve-Out region only applies for engines with a PM standard or FEL greater than or equal to 0.05 g/bhp-hr



The NTE standard applies during any conditions that could reasonably be expected to be seen by that engine in normal operation and use, within certain broad ranges of real ambient conditions. The NTE requirements will help to ensure emission benefits over the full range of in-use

[87] Torque is a measure of rotational force. The torque curve for an engine is determined by an engine "mapping" procedure specified in the Code of Federal Regulations. The intent of the mapping procedure is to determine the maximum available torque at all engine speeds. The torque curve is merely a graphical representation of the maximum torque across all engine speeds.

operating conditions. The NTE being finalized today for nonroad contains the same basic provisions as the highway NTE. This NTE control area is defined in the same manner as the highway NTE control area, and is therefore a subset of the engine's possible speed and load operating range. The NTE standard applies to emissions sampled during a time duration as small as 30 seconds. The NTE standard requirements for nonroad diesel engines are summarized below and specified in the regulations at 40 CFR 1039.101 and 40 CFR 1039.515. These requirements will take effect as early as 2011, as shown in shown in table III.J-1. The NTE standard applies to engines at the time of certification as well as in use throughout the useful life of the engine.

Table III.J-1. – NTE Standard Implementation Schedule

Power Category	NTE Implementation Model Year[a]
<25 hp	2013
25-75 hp	2013[b]
75-175 hp	2012
175-750 hp	2011
>750 hp	2011

Notes:

[a] The NTE applies for each power category once Tier 4 standards are implemented, such that all engines in a given power category are required to meet NTE standards.

[b] The NTE standard would apply in 2012 for any engines in the 50-75 hp range which choose not to comply with the proposed 2008 transitional PM standard.

The NTE test procedure can be run in nonroad equipment during field operation or in an emissions testing laboratory using an appropriate dynamometer. The test itself does not involve a specific operating cycle of any specific length; rather, it involves nonroad equipment operation of any type which could reasonably be expected to occur in normal nonroad equipment operation that could occur within the bounds of the NTE control area. The nonroad engine is operated under conditions that may reasonably be expected to be encountered in normal operation and use, including operation under steady-state or transient conditions and under varying ambient conditions. Emissions are averaged over a minimum time of thirty seconds and then compared to the applicable emission standard. The NTE standard applies over a wide range of ambient conditions, including up to an altitude of 5,500 feet above-sea level at ambient temperatures as high as 86 deg. F, and at sea-level up to ambient temperatures as high as 100 deg. F. The specific temperature and altitude conditions under which the NTE applies, as well as the methodology for correcting emissions results for temperature and/or humidity, are specified in the regulations.

For new nonroad diesel engines subject to the NTE standards, we will require that manufacturers state in their application for certification that they are able to meet the NTE standards under all conditions that may reasonably be expected to occur in normal equipment operation and use. Manufacturers will have to maintain a detailed description of any testing, engineering analysis, and other information that forms the basis for their statement. We believe that there is a variety of information that a manufacturer could use as a reasonable basis for a statement that engines are expected to meet NTE standards. For example, a reasonable basis could include data from laboratory steady-state and transient test cycle operation, a robust engine emissions map derived from laboratory testing (e.g., an emissions map of similar resolution to the engine's base fuel injection timing map) and technical analysis relying on good engineering judgment which are sufficient, in combination, to project emissions levels under NTE conditions reasonably expected to be encountered in normal operation and use. Data generated from in-use nonroad equipment testing to determine emission levels could, at the manufacturer's option, also be part of this combination. However, a reasonable basis for the manufacturer's statement does not require in-use emissions test data. This statement could reasonably be based solely on laboratory test data, analysis, and other information reasonably sufficient to support a conclusion that the engine will meet the NTE under conditions reasonably expected to be encountered in normal vehicle operation and use. If a manufacturer has relevant in-use nonroad emissions test data, it should be taken into consideration by the manufacturer in developing the basis for its statement.

In addition, as we proposed, we are finalizing a transition period during which a manufacturer could apply for an NTE deficiency for a nonroad diesel engine family. The NTE deficiency provisions would allow the Administrator to accept a nonroad diesel engine as compliant with the NTE standards even though some specific requirements are not fully met. We are finalizing these NTE deficiency provisions because we believe that, despite the best efforts of manufacturers, for the first few model years it is possible some manufacturers may have technical problems that are limited in nature but cannot be remedied in time to meet production schedules. We are not limiting the number of NTE deficiencies a manufacturer can apply for during the first three model years for which the NTE applies. For the fourth through the seventh model year after which the NTE standards are implemented, a manufacturer could apply for no more than three NTE deficiencies per engine family. Within an engine family, NTE deficiencies must be applied for on an engine model or power rating basis; however, the same deficiency when applied to multiple ratings or models counts as a single deficiency within an engine family. No deficiency may be applied for or granted after the seventh model year. The NTE deficiency provision will only be considered for failures to meet the NTE requirements. EPA will not consider an application for a deficiency for failure to meet the FTP or supplemental transient standards.

Similar to the 2007 highway HD rule, we are also finalizing a provision which would allow a manufacturer to exclude defined regions of the NTE engine control zone from NTE compliance if the manufacturer could demonstrate that the engine, when installed in a specified nonroad equipment applications(s), is not capable of operating in such regions. We have also

finalized a provision which would allow a manufacturer to petition the Agency to limit testing in a defined region of the NTE engine control zone during NTE testing. This optional provision would require the manufacturer to provide the Agency with in-use operation data which the manufacturer could use to define a single, continuous region of the NTE control zone. This single area of the control zone must be specified such that operation within the defined region accounts for 5 percent or less of the total in-use operation of the engine, based on the supplied data. Further, to protect against "gaming" by manufacturers, the defined region must generally be elliptical or rectangular in shape, and share a boundary with the NTE control zone. If approved by EPA, the regulations then disallow testing with sampling periods in which operation within the defined region constitutes more than 5.0 percent of the time-weighted operation within the sampling period.

The NTE numerical standard is a function of FTP emission standards contained in today's final rule, which standards are described in section II. As with the NTE standards we have established for the 2007 highway rule, the nonroad NTE standard is determined as a multiple of the engine families' underlying FTP emission standard. In addition, as with the 2007 highway standard, the multiple is either 1.25 or 1.5, depending on the emission pollutant type and the value of the FTP standard (or the engine families' FEL). These multipliers are based on EPA's assessment of the technological feasibility of the NTE standard, and our assessment that as the underlying FTP standard becomes more stringent, the NTE multiplier should increase (from 1.25 to 1.5). The FTP standard or FEL thresholds for the NTE standard's 1.25x multiplier and the 1.5x multiplier are specified for each regulated emission in table III.J-2.

Table III.J-2. – Thresholds for Applying NTE Standard of 1.25xFTP standard vs. 1.5x FTP Standard

Emission	Apply 1.25x NTE when...	Apply 1.5x when...
NO_X	NO_X std or FEL≥ 1.9 g/bhp-hr	NO_X std or FEL< 1.9 g/bhp-hr
NMHC	NO_X std or FEL≥ 1.9 g/bhp-hr	NO_X std or FEL< 1.9 g/bhp-hr
NO_X+NMHC	NMHC+NO_X std or FEL≥ 2.0 g/bhp-hr	NMHC+NO_X std or FEL< 2.0 g/bhp-hr
PM	PM std or FEL≥0.05 g/bhp-hr	PM std or FEL< 0.05 g/bhp-hr
CO	All stds or FELs	No stds or FELs

For example, beginning in 2011, the NTE standard for engines meeting a FTP PM standard of 0.01 g/bhp-hr and a FTP NO_X standard of 0.30 g/bhp-hr would be 0.02 g/bhp-hr PM and 0.45 g/bhp-hr NO_X. In the NPRM, we proposed a NO_X threshold value of 1.5 g/bhp-hr as the value at which the NTE multiplier would switch from 1.5 to 1.25.

We proposed this NO_X emission threshold level (1.5 g/bhp-hr) primarily because it is the same value as we finalized for the highway NTE. As shown in table III.J-2, we have finalized a

threshold value of 1.9 g/bhp-hr NO_X for nonroad engines. We have finalized this higher NO_X threshold based on the differences in the emission performance of NO_X control technologies between highway and nonroad diesel engines. Specifically, nonroad diesel NO_X standards have traditionally been higher than the equivalent highway NO_X standard due primarily to the effectiveness of charge-air-cooling and the lack of ram-air for nonroad applications. For example, the nonroad Tier 3 NMHC+NO_X standards are higher than the 2004 heavy-duty highway standards (e.g., 3.0 g/bhp-hr vs. 2.5 g/bhp-hr), and the Tier 4 NO_X standard is higher than the 2007 heavy-duty highway standard (e.g., 0.3 g/bhp-hr vs. 0.2 g/bhp-hr). We expect that the nonroad Tier 3 standard for engines above 100 hp will require NO_X levels of approximately 2.5 g/bhp-hr and we expect that for the 2004 highway heavy-duty standards, NO_X levels are approximately 2 g/bhp-hr. In both cases, these emission levels are the building blocks for the next set of EPA standards (e.g., Tier 4 for nonroad and 2007 for highway). Because the nonroad Tier 3 NO_X emission levels are expected to be approximately 25 percent greater than the 2004 highway level (2.5 vs 2), we believe that the NTE NO_X multiplier threshold for nonroad should be 25 percent greater for nonroad as compared to highway. For these reasons, we have finalized a NO_X multiplier threshold of 1.9 g/bhp-hr, which is 25 percent greater than the highway multiplier threshold.

In addition, as proposed, we are finalizing a number of specific engine operating conditions during which the nonroad NTE standard would not apply. The exact criteria for these conditions are defined in the regulations, but in summary: the NTE does not apply during engine start-up conditions; the NTE does not apply during very cold engine intake air temperatures for EGR- equipped engines during which the engine may require an engine protection strategy; and, finally, for engines equipped with NO_X and/or NMHC aftertreatment (such as a NO_X adsorber), the NTE does not apply during warm-up conditions for the exhaust emission control device. Finally, while we did not propose this, we are finalizing the NTE PM carve-out provisions for engines which will not require PM filters. The PM only carve-out is a sub-region of the NTE zone in which the NTE PM standard does not apply. Figure III.J-1 contains an illustration of the PM carve-out. This is a region of high engine speed and low engine torque during which engine-out PM emissions are difficult to control to levels below the PM NTE standard. The dimensions of the PM carve-out are specified in the regulations. For engines equipped with a PM filter, compliance with the PM NTE standard in this region is achievable due to the highly efficient PM reduction capabilities of the CDPF technology. However, for engines in the under 25 hp category, for which we have established Tier 4 emission standards that do not require the use of a PM filter, PM control in this sub-region of the NTE zone with conventional PM reduction technologies may not be achievable. Therefore, as we allowed with highway heavy-duty engines certifying to the 0.1 g/bhp-hr standard, we have created a PM carve-out for nonroad engines that use in-cylinder PM control technologies. Specifically, the PM carve-out applies to engines meeting a PM standard or FEL greater than or equal to 0.05 g/bhp-hr.

K. Investigating and Reporting Emission-Related Defects

In 40 CFR part 1068, subpart F, we are adopting defect reporting requirements that obligate manufacturers to tell us when they learn that emission-control systems are defective and to conduct investigations under certain circumstances to determine if an emission-related defect is present. Under these defect-reporting requirements, manufacturers must track available warranty claims and any other available information from dealers, hotlines, diagnostic reports, or field-service personnel to identify possible defects. If the number of possible defects exceeds certain thresholds, they must investigate future warranty claims and other information to establish whether these are actual defects.

We believe the investigation requirement in this rule will allow both EPA and the engine manufacturers to fully understand the significance of any unusually high rates of warranty claims for systems or parts that may have an impact on emissions. In the past, defect reports were submitted based on a very low threshold with the same threshold applicable to all size engine families and with little information about the full extent of the problem. The new approach should result in fewer overall defect reports being submitted by manufacturers than would otherwise be required under the old defect-reporting requirements because the number of defects triggering the submission requirement rises with the engine family size. The new approach may trigger some additional reports for small-volume families, but the percentage-based approach will ensures that investigations and reports correspond to issues that are likely to be significant.

Part 1068, subpart F, is intended to require manufacturers to use information we would expect them to keep in the normal course of business. We believe in most cases manufacturers will not be required to institute new programs or activities to monitor product quality or performance. A manufacturer that does not keep warranty or replacement part information may ask for our approval to use an alternate defect-reporting methodology that is at least as effective in identifying and tracking possible emission-related defects as the requirements of 40 CFR 1068.501. Thus manufacturers will have the flexibility to develop defect tracking and reporting programs that work better for their standard business practices. However, until we approve such a request, the thresholds and procedures of subpart F continue to apply.

Manufacturers may also ask for our approval to use an alternate defect-reporting methodology when the requirements of 40 CFR 1068.501 can be demonstrated to be highly impractical or unduly burdensome. In such cases, we will generally allow alternate methodologies that are at least as effective in identifying, correcting, and informing EPA of possible emission-related defects as the requirements of 40 CFR 1068.501. We expect this flexibility to be useful in special circumstances such as when new models of very large engines are introduced for the first time. In this situation, it may be appropriate to allow an alternate defect reporting method because the high cost of these engines often makes it impractical to build and test large numbers of prototype engines. The initial production of these engines can have similar defect rates to the high levels often associated with prototype engines. While we are concerned about such defects and want to be kept informed about them, it is not clear that our

basic program would be the best way to address these defects. In such cases, we believe it may be more appropriate for manufacturers to propose an alternative approach that consolidates reports on a regular interval, such as quarterly, and identifies obvious early-life defects without a formal tracking process. In general, we would encourage manufacturers to propose an alternate approach to ensure that these defects are properly addressed while minimizing the associated burden.

Issues related to parts shipments received the most attention from commenters who pointed out that the proposed requirement to track shipments of all emission-related components was overly burdensome and not likely to reveal useful information. We have concluded that it is not appropriate to use parts shipments as a quantitative indicator to evaluate whether manufacturers exceed the threshold that would trigger an investigation. We generally agree with manufacturers concerns that parts-shipments data would be too difficult to evaluate, for example, because parts are often shipped for stocking purposes, parts are installed in compliant and noncompliant products (such as exported engines), and part shipments are generally not identifiable by model year. The final rule therefore requires manufacturers to pursue a defect investigation if the number of shipped parts is higher than the manufacturer would expect based on historical shipment levels, specifications for scheduled maintenance, or other factors.

We have modified the proposed thresholds to address concerns that manufacturers would be required to investigate and report defects too frequently. For engines under 750 hp, we are adopting investigation thresholds of 10 percent of total production or 50 engines, whichever is greater, for any single engine family in one model year. Similarly, we are adopting defect-reporting thresholds of 2 percent of total production or 20 engines, whichever is greater. For engines over 750 hp, the same percentage thresholds apply, but we are extending the percentage values down to smaller engine families to reflect their disproportionate contribution to total emissions. For these engines, the absolute thresholds are 25 engines for investigations and 10 or 15 engines for defects (see table III.K-1). We believe these thresholds adequately balance the desire to document emission-related defects without imposing an unreasonable reporting burden. Also, we believe this approach to adopting thresholds adequately addresses reporting requirements for aftertreatment and non-aftertreatment components.

Table III.K-1. – Investigation and Defect-Reporting Thresholds for Varying Sizes of Engine Families[1]

Engine Size	Investigation Threshold	Defect-reporting Threshold
≤ 750 hp	less than 500: 50 500-50,000: 10 % 50,000+: 5,000	less than 1,000: 20 1,000-50,000: 2 % 50,000+: 1,000
> 750 hp	less than 250: 25 250+: 10 %	less than 150: 10 150-750: 15 750+: 2 %

Notes:

[1] For varying sizes of engine families, based on sales per family in a given model year.

EMA also expressed concern about the existing regulatory language in 40 CFR 1068.501(b)(3), which states that manufacturers must "consider defects that occur within the useful life period, or within five years after the end of the model year, whichever is longer." However, this provision has no effect on the diesel engines subject to the Tier 4 standards being adopted today, since they all have useful lives of at least five years. We recognize that this issue may be relevant to engine categories that do not have five-year useful lives, such as small SI engines, and will consider these concerns in our future regulation of such engines.

When manufacturers start an investigation, they must consider any available information that would help them evaluate whether any of the possible defects that contributed to triggering the investigation threshold would lead them to conclude that these were actual defects. Otherwise, manufacturers are expected to look prospectively at any possible defects and attempt to determine whether these are actual defects. Also, during an investigation, manufacturers should use appropriate statistical methods to project defect rates if they are unable to collect information to evaluate possible defects, taking steps as necessary to prevent bias in sampled data (or making adjusted calculations to take into account any bias that may remain). For example, if 75 percent of the components replaced under warranty are available for evaluation, it would be appropriate to extrapolate known information on failure rates to the components that are unavailable for evaluation.

The second threshold in 40 CFR 1068.501 specifies when a manufacturer must report that there is an emission-related defect. This threshold involves a smaller number of engines because

each possible occurrence has been screened to confirm that it is in fact an emission-related defect. In counting engines to compare with the defect-reporting threshold, the manufacturer generally considers a single engine family and model year. Where information cannot be differentiated by engine family and model year, the manufacturer must use good engineering judgment to evaluate whether the information leads to a conclusion that the number of defects exceeds the applicable thresholds. However, when a defect report is required, the manufacturer must report all occurrences of the same defect in all engine families and all model years.

If the number of engines with a specific defect is found to be less than the threshold for submitting a defect report, but information such as warranty data later indicates that there may be additional defective engines, all the information must be considered in determining whether the threshold for submitting a defect report has been met. If a manufacturer has actual knowledge from any source that the threshold for submitting a defect report has been met, a defect report must be submitted even if the trigger for investigating has not yet been met. For example, if manufacturers receive from their dealers, technical staff or other field personnel information showing conclusively that there is a recurring emission-related defect, they must submit a defect report.

If manufacturers trigger the threshold to start an investigation, they must promptly and thoroughly investigate whether their parts are defective, collecting specific information to prepare a report describing their conclusions. Manufacturers must send the report if an investigation concludes that the number of actual defects did not exceed reporting thresholds. Manufacturers must also send these as status reports twice annually during an investigation. After investigating for several months, or perhaps a couple years, it may become clear that the problems that triggered the investigation will never show enough actual defects to trigger a defect report. In this case, the manufacturer would send us a report justifying this conclusion.

In general, we believe this updated approach to defect reporting will decrease the number of defect reports submitted by manufacturers overall while significantly improving their quality and their value to both EPA and the manufacturer.

Note that misbuilds are a special type of emission-related defect. An engine that is not built consistent with its application for certification violates the prohibited act of introducing into commerce engines that are not covered by a certificate of conformity.

L. Compliance with the Phase-In Provisions

In section II we described the NO_X and NMHC standards phase-in schedule, which is intended to allow engine manufacturers to phase-in their new advanced technology engines, while they phase-out existing engines. This phase-in requirement is based on percentages of a manufacturer's production for the U.S. market. We recognize, however, that manufacturers need to plan for compliance well in advance of the start of production, and that actual production volumes for any one model year may differ from their projections. On the other hand, we believe

that it would be inappropriate and infeasible to base compliance solely on a manufacturer's projections. That could encourage manufacturers to overestimate their production of complying phase-in engines, and could result in significantly lower emission benefits during the phase-in. In response to these concerns, we proposed to initially only require nonroad diesel manufacturers to project compliance with the phase-in based on their projected production volumes, provided that they made up any deficits (in terms of percent of production) the following year. We received no comments on this issue and are finalizing it as proposed.

Because we expect that a manufacturer making a good-faith projection of sales would not be very far off of the actual production volumes, we are limiting the size of the deficit that would be allowed, as in the highway program. In all cases, the manufacturer would be required to produce at least 25% of its production in each phase-in power category as “phase-in” engines (meeting the NO_X and NMHC standards or demonstrating compliance through use of ABT credits) in the phase-in years (after factoring in any adjustments for early introduction engine credits; see section III.M). This minimum required production level would be 20% for the 75-175 hp category if a manufacturer exercises the option to comply with a reduced phase-in schedule in lieu of using banked Tier 2 ABT credits, as discussed in section III.A.1.b. Another important restriction is that manufacturers would not be allowed to have a deficit in the year immediately preceding the completion of the phase-in to 100%. This would help ensure that manufacturers are able to make up the deficit. Since they could not produce more than 100% low-NO_X engines after the final phase-in year, it would not be possible to make up a deficit from this year. These provisions are identical to those adopted in the highway HDDE program.

We are also finalizing the proposed “split family” allowance for the phase-in years. This provision, which is similar to a provision of the highway program, allows manufacturers to certify engine families to both the phase-in and phase-out standards. Manufacturers choosing this option must assign at the end of the model year specific numbers of engines to the phase-in and phase-out categories. All engines in the family must be labeled with the same NO_X and PM FELs, which apply for all compliance testing, and must meet all other requirements that apply to phase-in engines. Engines assigned to the phase-out category may generate emission credits relative to the phase-out standards.

M. Incentive Program for Early or Very Low Emission Engines

We believe that it is appropriate and beneficial to provide voluntary incentives for manufacturers to introduce engines emitting at very low levels early. Such inducements may help pave the way for greater and/or more cost effective emission reductions from future engines and vehicles. To encourage early introduction of low-emission engines, the proposal contained provisions to allow engine manufacturers to benefit from producing engines certified to the final (aftertreatment-based) Tier 4 standards prior to the 2011 model year, by being allowed to make fewer engines certified to these standards once the Tier 4 program takes effect, a concept that we are terming "engine offsets" to avoid confusion with ABT program credits. The number of offsets that could be generated would depend on the degree to which the engines are able to meet, or

perform better than, the final Tier 4 standards. Commenters generally supported this approach, as long EPA ensures that compliance requirements for these engines are enforced.

However, one equipment manufacturer submitted comments suggesting that we should adopt a program that would provide incentives for equipment manufacturers to use the early Tier 4 engines in their equipment. For an early low-emission engine program to be successful, we agree that it is important to provide incentives to both the engine manufacturer and the equipment manufacturer, who may incur added cost to install and market the advanced engine in the equipment. As was pointed out in comments, the proposed program did not provide clear incentives to equipment manufacturers to use the (presumably more expensive) early low-emission engines. Therefore, we are adding such provisions. Section III.B.2.e describes these early Tier 4 engine incentive provisions under which equipment manufacturers can earn increased allowance flexibilities. Under those provisions, the engine manufacturer's incentive to produce the low-emitting engines will come from customers' demand for them, and from the fact that the engine manufacturer can earn ABT program credits for these engines in the same way as without these incentive provisions. If the equipment manufacturer does not wish to earn the increased allowance flexibilities, then the engine manufacturer would be allowed to use the provisions of the incentive program for early low-emission engines described below in this subsection, though to do so would require the forfeiture of any ABT credits earned by the subject engines, essentially to avoid double counting, as explained below. This engine manufacturer incentive program is being adopted as proposed, except for engines above 750 hp, for which the proposed program requires some adjustment to account for the approach we are taking to final standards.

As discussed in section II.A.4, the final rule does not phase in standards for engines above 750 hp as proposed, and instead adopts application-specific standards in 2011 and 2015. The 2011 standards are not based on advanced aftertreatment except for NO_X on engines above 1200 hp used in generator sets. To avoid overcomplication of the incentive program, which might discourage its use, we are not separating over and under 1200 hp generator set engines into separate groups for these provisions. Instead, any of these engines that meet the 2015 standards before 2015 can earn offsets. We are, however, separating the generator set engines and non-generator set engines above 750 hp into separate groups, because we are deferring setting a NO_X standard for the latter that is based on use of advanced aftertreatment technology.

Table III.M-1 summarizes the requirements and available offsets for engine manufacturers in this program. As the purpose of the incentive is to encourage the introduction of clean technology engines earlier than required, we require that the emission standard levels actually be met, and met early, by qualifying engines to earn the early introduction offsets. The regulations specify that the standards must be met without the use of ABT credits and actual production of the engines must begin by September 1 preceding the first model year when the standards would otherwise be applicable. Also, to avoid double-counting, as explained in the proposal, the early engines can earn either the engine offsets or the ABT emission credit, but not both. Note that this is different than the approach taken in the early Tier 4 engine incentive program for equipment manufacturers described in section III.B.2.e, where incentives for both the engine manufacturer

(ABT credits) and the equipment manufacturer (allowance flexibilities) are needed to ensure successful early introduction of clean engines. Because 15 ppm sulfur diesel fuel will be available on a widespread basis in time for 2007 (due to the requirements for on-highway heavy-duty engines), we are allowing engine manufacturers to begin certifying engines to the very low emission levels required to be eligible for this incentive program, beginning with the 2007 model year.

Table III.M-1. – Program for Early Introduction of Clean Engines

Category	Engine Group	Must Meet [a]	Per-Engine Offset
Early PM-only [b]	25-75 hp	0.02 g/bhp-hr PM	1.5-to-1 PM-only
	75-750 hp	0.01 g/bhp-hr PM	
Early Engine [b]	25-75 hp	0.02 / 3.5 g/bhp-hr PM / NMHC+NO_X	1.5-to-1
	75-750 hp	0.01 / 0.30 / 0.14 g/bhp-hr PM / NO_X / NMHC	
	>750 hp generator set	0.02 / 0.50 / 0.14 g/bhp-hr PM / NO_X / NMHC	
	>750 hp non-generator set	0.03 / 2.6 / 0.14 g/bhp-hr PM / NO_X / NMHC	
Low NO_X Engine	>25 hp	as above for Early Engine, except must meet 0.15 g/bhp-hr NO_X standard	2-to-1

Notes:

[a] All engines must also meet the Tier 4 crankcase emissions requirements. Engines must certify using all test and other requirements (such as NRTC and NTE) otherwise required for final Tier 4 standards.

[b] Offsets must be earned prior to the start of phase-in requirements in applicable engine groups (prior to 2013 for 25-75 hp engines, prior to 2012 for 75-175 hp engines, prior to 2011 for 175-750 hp engines, prior to 2015 for >750 hp engines).

For any engines being certified under this program before the 2011 model year using 15 ppm sulfur certification fuel, the manufacturer would have to meet the requirements described in section III.D, including demonstrating that the engine would indeed be fueled with 15 ppm sulfur fuel in the field. We expect this would occur through selling such engines into fleet applications, such as municipal maintenance fleets, large construction company fleets, or any such well-managed centrally-fueled fleet. While obtaining a reliable supply of 15 ppm maximum sulfur diesel fuel prior to the 2011 model year will be possible, it will require some effort by nonroad diesel machine operators. We therefore believe it is necessary and appropriate to provide a greater incentive for early introduction of clean diesel technology. Thus, as proposed, we would count one early engine (that is, an engine meeting the final Tier 4 standards) as offsetting 1.5 engines later. This means that fewer clean diesel engines than otherwise required may enter the market in later years, but, more importantly, it means that emission reductions would be realized earlier than

under our base program. We believe that providing incentives for early emission reductions is a worthwhile goal for this program, because improving air quality is an urgent need in many parts of the country as explained in section I, and because the early learning opportunity with new technologies can help to ensure a smooth transition to Tier 4 standards.

We are providing this early introduction offset for engines over 25 hp that meet all of today's Tier 4 emissions standards (NO_X, PM, and NMHC) in the applicable engine category. We are also providing this early introduction offset to engines that pull ahead compliance with only the PM standard. However, a PM-only early engine would offset only the PM standard for an offset-using engine. For engines in power categories with a percentage phase-in, this would correspond (during the phase-in years) to offset use for "phase-out" engines (those required to meet the new Tier 4 standard for PM but not for NO_X or NMHC). Engines using the PM-only offset would be subject to the other applicable Tier 4 emission standards, including applicable transient and NTE standards (see Section III.F) and crankcase requirements. The applicable PM standard and requirements for these PM-only offset-using engines would be those of Tier 3 (Tier 2 for 25-50 hp engines). PM-only offsets would not offset engines required to meet other Tier 4 standards such as the phase-in NO_X and NMHC standards (since there is no reason for PM offsets to offset emissions of other pollutants). Tier 4 engines between 25 and 75 hp certified to the 2008 PM standard would not participate in this program, nor would engines below 25 hp, because they do not have advanced aftertreatment-based standards.

An important aspect of the early incentive provision is that it must be done on an engine count basis. That is, a diesel engine meeting new standards early would count as 1.5 such diesel engines later. This contrasts with a provision done on an engine percentage basis which would count one percent of diesel engines early as 1.5 percent of diesel engines later. Basing the incentive on an engine count alleviates any possible influence of fluctuations in engine sales in different model years.

Another important aspect of this program is that it is limited to engines sold prior to the 2013 model year for engines between 25 and 75 hp, prior to the 2012 model year for engines between 75 and 175 hp, and prior to the 2011 model year for engines between 175 and 750 hp. In other words, as in the highway program, nonroad diesel engines sold during the transitional "phase-in" model years would not be considered "early" introduction engines and would therefore be ineligible to generate early introduction offsets. However, such engines and vehicles would still be able to generate ABT credits. Because the engines over 750 hp engines have no percent-of-production phase-in provisions, we are allowing offsets for early engines in any model year prior to 2015. For the same reason, there is no PM-only offset for these engines. As with the phase-in itself, and for the same reasons, an early introduction engine could only be used to offset requirements for engines in the same engine group (25-75 hp, 75-175 hp, 175-750 hp, >750 hp generator sets, and >750 hp non-generator sets) as the offset-generating engine.

As a further incentive to introduce clean engines and vehicles early, we are also adopting the proposed provision that gives engine manufacturers an early introduction offset equal to two

engines during or after the phase-in years for engines with NO_X levels well below the final Tier 4 NO_X standard. This incentive applies for diesel engines achieving a 0.15 g/bhp-hr NO_X standard level (one-half of the aftertreatment-based standard for most engines) while also meeting the NMHC and PM standards. Due to the extremely low emission levels to which these engines and vehicles would need to certify, we believe that the double engine count offset is appropriate.

In the NPRM we asked for comment on whether or not we should extend the existing Blue Sky program that encourages the early introduction of engines with emission levels (as measured on a transient test) about 40% lower than the Tier 2 standards levels. See 68 FR at 28483. We received comments both for and against doing so, but no commenter provided substantive arguments or information. Given the very low emissions levels being adopted in Tier 4, we have decided not to extend the existing Blue Sky Series program, because it does not encourage engines emitting at such low emission levels.

N. Labeling and Notification Requirements

As explained in section II, the emissions standards will make it necessary for manufacturers to employ exhaust emission control devices that require very low-sulfur fuel (less than 15 ppm) to ensure proper operation. This action restricts the sulfur content of diesel fuel used in these engines. However, the 2008 emissions standards would be achievable with less sensitive technologies and thus it could be appropriate for those engines to use diesel fuel with up to 500 ppm sulfur. There could be situations in which vehicles requiring either 15 ppm fuel or 500 ppm may be accidentally or purposely misfueled with higher-sulfur fuel. Any of these misfueling events could seriously degrade the emission performance of sulfur-sensitive exhaust emission control devices, or perhaps destroy their functionality altogether.

In the highway rule, we adopted a requirement that heavy-duty vehicle manufacturers notify each purchaser that the vehicle must be fueled only with the applicable low-sulfur diesel fuel. We also required that diesel vehicles be equipped by the manufacturer with labels near the refueling inlet to indicate that low sulfur fuel is required. We are adopting similar requirements here.[88] Specifically, manufacturers will be required to notify each purchaser that the nonroad engine must be fueled only with the applicable low-sulfur diesel fuel, and ensure that the equipment is labeled near the refueling inlet to indicate that low sulfur fuel is required. We believe that these measures would help owners find and use the correct fuel and would be sufficient to address misfueling concerns. Thus, more costly provisions, such as fuel inlet restrictors, should not be necessary.

In general, beginning in model year 2011, nonroad engines will be required to use the Ultra Low Sulfur diesel fuel (with less than 15 ppm sulfur). Thus, the default label will state "ULTRA LOW SULFUR FUEL ONLY." The labeling requirements for earlier model year Tier 4

[88] We also required that highway vehicles be labeled on the dashboard. Given the type of equipment using nonroad CI engines, we are not adopting any dashboard requirement here.

engines are specified in §1039.104(e). Some new labeling requirements for earlier model year Tier 3 engines are specified in 40 CFR 89.330(e). These requirements for earlier years generally require that engines and equipment be labeled consistent with the sulfur of the test fuel used for their certification. So where the engine is certified using Low Sulfur diesel fuel (with less than 500 ppm sulfur), the required label will state "LOW SULFUR FUEL ONLY." See section III.D and the regulatory text for the other specific requirements related to labeling the earlier model years.

O. General Compliance

1. Good engineering judgment

The process of testing engines and preparing an application for certification requires the manufacturer to make a variety of judgments. This includes, for example, selecting test engines, operating engines between tests, and developing deterioration factors. EPA has the authority to evaluate whether a manufacturer's use of engineering judgment is reasonable. The regulations describe the methodology we use to address any concerns related to how manufacturers use good engineering judgment in cases where the manufacturer has such discretion (see 40 CFR 1068.5). If we find a problem with a manufacturer's use of engineering judgment, we will take into account the degree to which any error in judgment was deliberate or in bad faith. If manufacturers object to a decision we make under this provisions, they are entitled to a hearing. This subpart is consistent with provisions already adopted for light-duty highway vehicles, marine diesel engines, industrial spark-ignition engines, and recreational vehicles.

2. Replacement engines

In the proposal we included a provision allowing manufacturers to sell a new, noncompliant engine intended to replace an engine that fails in service. The proposed language closely mirrored the existing provisions in 40 CFR 89.1003(b)(7), except that it specified that manufacturers could produce new, noncompliant replacement engines if no engine from any manufacturer were available with the appropriate physical or performance characteristics. Manufacturers objected to this provision and requested that the final regulations follow the language in 40 CFR part 89, in which the manufacturer of the new engine confirm that no appropriate engine is available from its product line (or that of the manufacturer of the original engine, if that were a different company). We agree that the language from 40 CFR part 89 is appropriate, but we note two things to address remaining concerns that manufacturers could potentially use the replacement-engine provisions to produce large numbers of noncompliant products. First, we are including a specific statement in the regulations that manufacturers may not use the replacement-engine exemption to circumvent the regulations. Second, we plan to use the data-collection provision under 40 CFR 1068.205(d) to ask manufacturers to report the number of engines they sell under the replacement-engine exemption. Rather than adopting a specific data-reporting requirement, we believe this more flexible approach is most appropriate to allow us to get information to evaluate how manufacturers are using the exemption without

imposing reporting requirements that may involve more or less information than is actually needed.

3. Warranty

We are modifying 40 CFR 1068.115 regarding engine manufacturers' warranty obligations by removing paragraph (b). This paragraph addresses specific circumstances under which manufacturers may not deny emission-related warranty claims, while paragraph (a) of this section addresses the circumstances under which manufacturers may deny such claims. As described in our Summary and Analysis of Comments related to our November 8, 2002 final rule (67 FR 68242), we intended to adopt 40 CFR1068.115 without this paragraph. We wanted to remove paragraph (b) because we agreed with a comment pointing out that publishing both paragraphs leaves ambiguous which provision applies if a situation applies that is not on either list. Since neither list can be comprehensive, we believe the provisions in paragraph (a) describing when manufacturers may deny warranty claims appropriately addresses the issue. As a result, paragraph (b) was inadvertently adopted as part of the November 2002 final rule.

4. Separate catalyst shipment

We are adopting provisions that will allow engine manufacturers to ship engines to equipment manufacturers where the engine manufacturer had not yet installed the aftertreatment or otherwise included it as part of the engine shipment. This allows the engine manufacturer to ship the engine without the aftertreatment; for example, in cases where it would be impractical to install aftertreatment devices on the engine before shipment or even ship products with the aftertreatment devices uninstalled along with the engine; or where shipping it already installed would require it to be disassembled and reinstalled when the engine was placed in the equipment. Today's final rule requires that the components be included in the price of the engine and that the engine manufacturer provide sufficiently detailed and clear instructions so that the equipment manufacturer can readily install the engine and its ancillary components in a configuration covered under the certificate of conformity held by the engine manufacturer. We are also requiring that the engine manufacturer have a contractual agreement obligating the equipment manufacturer to complete the final assembly into a certified configuration. The engine manufacturer must ship any components directly to the equipment manufacturer or arrange for their shipment from a component supplier. The engine manufacturer must tag the engines and keep records. The engine manufacturer must obtain annual affidavits from each equipment manufacturer as to the parts and part numbers that the equipment manufacturer installed on each engine and must conduct a limited number of audits of equipment manufacturers' facilities, procedures, and production records to monitor adherence to the instructions it provided. Where an equipment manufacturer is located outside of the U.S., the audits may be conducted at U.S. port of distribution facilities.

The rule also contains various provisions establishing responsibility for proper installation. Where the engines are not in a certified configuration when installed in nonroad equipment

because the equipment manufacturer used improper emission-control devices or failed to install the shipped parts or failed to install the devices correctly, then both the engine manufacturer and the installer have responsibility. For the engine maker, the exemption is void for those engines that are not in their certified configuration after installation. We may also suspend or revoke the exemption for future engines where appropriate, or void the exemption for the entire engine family. The installer is also liable. We may find the equipment manufacturer to be in violation of the tampering prohibitions at 40 CFR 1068.101(b)(1) for the improper installation, which could subject it to substantial civil penalties. In any event, the engine manufacturer remains liable for the in-use compliance of the engine as installed. For example, it has responsibility for the emission-related warranty, including for the aftertreatment, and is responsible for any potential recall liability. However, if noncompliance of the in-use engines stems from improper installation of the aftertreatment, then the tampering that occurred by the installer may remove recall liability. Where the engine manufacturer had complied with the regulations and the failure was solely due to the equipment manufacturer's actions, we would not be inclined to revoke or suspend the exemption or to void the exemption for the entire engine family. We may deny the exemption for future model years if the engine manufacturer does not take action to address the factors causing the nonconformity. On the other hand, if the manufacturer failed to comply, had shipped improper parts, had provided instructions that led to improperly installed parts, or had otherwise contributed to the installation of engines in an uncertified configuration, we might suspend, revoke, or void the exemption for the engine family. In this case, the engine manufacturer would be subject to substantial civil penalties.

P. Other Issues

We are also making other minor changes to the compliance program. These changes are summarized in table III.Q-1 below. For more information about these changes, you should read the NPRM and Summary and Analysis of Comments for this rulemaking. We believe that these changes are straightforward and noncontroversial.

Table III.Q-1. – Regulatory Changes

Issue	Regulatory provision
Applicability to alcohol-fueled engines	§§1039.101, 1039.107
Prohibited controls	§1039.115
Emission-related maintenance instructions	§1039.125
Engine installation instructions	§1039.130
Engines labels	§§1039.20, 1039.135, 1068.320
Engine family definition	§1039.230
Test engine selection	§1039.235
Deterioration factors	§1039.240
Engines that use noncommercial fuels	§1039.615
Use of good engineering judgment	§1068.5
Separate shipment of aftertreatment	§1068.260
Exemptions	40 CFR 1068 Subpart C
Importing engines	40 CFR 1068 Subpart D
Hearings	40 CFR 1068 Subpart G

Q. Highway Engines

We are changing the diesel engine/vehicle labeling requirements in 40 CFR 86.007-35 to be consistent with the new pump labels. This change corrects a mistake in the proposal that would have resulted in confusion for highway vehicle operators. (We received no comment on this issue.)

R. Changes That Affect Other Engine Categories

We are making some minor changes to the regulations in 40 CFR parts 1048 and 1051 for nonroad spark-ignition engines over 19 kW and recreational vehicles, respectively. We are also changing several additional provisions in 40 CFR parts 1065 and 1068, which define test procedures and compliance provisions for these same categories of engines. See the regulatory text for the specific changes. The proposed rule included most of these changes. To the extent

there were comments on any of these changes, those issues are addressed elsewhere in this document or in the Summary and Analysis of Comments.

- In 40 CFR 1048.125 and 40 CFR 1051.125, we are correcting the provisions related to critical emission-related maintenance to allow manufacturers to do maintenance during service accumulation for durability testing, as long as their maintenance steps meet the specified criteria ensuring that in-use engines will undergo those maintenance procedures.
- In 40 CFR 1068.27, we clarify that manufacturers must make available a reasonable number of production-line engines so we can test or inspect them if we make such a request.
- We are changing the definition of nonroad engine to explicitly exclude aircraft engines. This is consistent with our longstanding interpretation of the Clean Air Act. Clarifying the definition this way allows us to more clearly specify the applicability of the fuel requirements to nonroad engines in this final rule.
- We are adding a provision directing equipment manufacturers to request duplicate labels from engine manufacturers and keep appropriate records if the original label is obscured in the final installation. The former approach under 40 CFR part 1068 was to require equipment manufacturers to make their own duplicate labels as needed. We intend to amend 40 CFR parts 1048 and 1051 to correspond with this change.
- As described above in section III, we are revising the criteria manufacturers would use to show that they may use the replacement-engine exemption under 40 CFR 1068.240. We also clarify that we may require manufacturers to report to us how many engines they sell in given year under the replacement-engine exemption.
- As described above and in the Summary and Analysis of Comments, we are adding a provision in 40 CFR 1068.260 to allow manufacturers to ship aftertreatment devices directly from the component supplier to the equipment manufacturer. This regulatory section includes several provisions to ensure that the equipment manufacturer installs the aftertreatment device in a way that brings the engine to its certified configuration.
- As described above, we are modifying the defect-reporting requirements in 40 CFR 1068.501.
- While most of the changes being adopted for part 1065 will only affect diesel nonroad engines, we are also making minor changes that will also apply for SI engines. These changes, however, are generally limited to clarifications, corrections, and options. They will not affect the stringency of the standards or create new burdens for manufacturers.

IV. Our Program for Controlling Nonroad, Locomotive and Marine Diesel Fuel Sulfur

We are finalizing today a two-step sulfur standard for nonroad, locomotive and marine (NRLM) diesel fuel that will achieve significant, cost-effective sulfate PM and SO_2 emission reductions. These emission reductions will, by themselves, provide dramatic environmental and public health benefits which far outweigh the cost of meeting the standards necessary to achieve them. In addition, the final sulfur standards for nonroad diesel fuel will enable advanced high efficiency emission control technology to be applied to nonroad engines. As a result, these nonroad fuel sulfur standards, coupled with our program for more stringent emission standards for new nonroad engines and equipment, will also achieve dramatic NO_X and PM emission reductions. Sulfur significantly inhibits or impairs the function of the diesel exhaust emission control devices which will generally be necessary for nonroad diesel engines to meet the emission standards finalized today. With the 15 ppm sulfur standard for nonroad diesel fuel, we have concluded that this emission control technology will be available for model year 2011 and later nonroad diesel engines to achieve the NO_X and PM emission standards adopted today. The benefits of today's program also include the sulfate PM and SO_2 reductions achieved by establishing the same standard for the sulfur content of locomotive and marine diesel fuel.

The sulfur requirements established under today's program are similar to the sulfur limits established for highway diesel fuel in prior rulemakings – 500 ppm in 1993 (55 FR 34120, August 21, 1990) and 15 ppm in 2006 (66 FR 5002, January 18, 2001). Beginning June 1, 2007, refiners will be required to produce NRLM diesel fuel with a maximum sulfur content of 500 ppm. Then, beginning June 1, 2010, the sulfur content will be reduced for nonroad diesel fuel to a maximum of 15 ppm. The sulfur content of locomotive and marine diesel fuel will be reduced to 15 ppm beginning June 1, 2012. The program contains certain provisions to ease refiners' transition to the lower sulfur standards and to enable the efficient distribution of all diesel fuels. These provisions include the 2012 date for locomotive and marine diesel fuel, early credits for refiners and importers and special provisions for small refiners, transmix processors, and entities in the fuel distribution system.

In general, the comments we received during the public comment period supported the proposed program. Adjustments we have made to the proposed program will make the final program even stronger, both in terms of our ability to enforce it and the environmental and public health benefits that it will achieve. In particular, today's final program contains provisions to smooth the refining industry's transition to the low sulfur fuel requirements, encourage earlier introduction of cleaner burning fuel, maintain the fuel distribution system's flexibility to fungibly distribute similar products, and provide an outlet for off-specification distillate product, all while maintaining, and even enhancing, the health and environmental benefits of today's program.

The first adjustment that we made to the proposed program was to move from the "refiner baseline" approach discussed in the proposal to a "designate and track" approach. Under the proposed refiner baseline approach, any refiner or importer could choose to fungibly distribute its

500 ppm sulfur NRLM and highway diesel fuels without adding red dye to the NRLM at the refinery gate. However, the refiners' production would then be subject to a non-highway distillate baseline, established as a percentage of its total distillate fuel production volume. While EPA preferred this approach in the proposal, we decided not to finalize it because we concluded that it would have unnecessarily constrained refiners' ability to meet market demands. It would have encouraged them to dye 500 ppm sulfur NRLM at the refinery gate, resulting in an additional grade of diesel fuel and, consequently, an added burden to the distribution system. Furthermore, we were concerned that it would have created a trend that could reduce the volume of 15 ppm sulfur highway diesel fuel and potential options to remove the market constraints could have increased the possibility for reduced volume.

In place of the refiner baseline approach, we are finalizing a designate and track approach. The final designate and track approach is a modified version of the designate and track approach discussed in the proposal. As finalized it now allows us to enforce the program through the entire distribution system. In essence, the final designate and track approach requires refiners and importers to designate the volumes of diesel fuel they produce and/or import. Refiners/importers will identify whether their diesel fuel is highway or NRLM and the applicable sulfur level. They may then mix and fungibly ship highway and NRLM diesel fuels that meet the same sulfur specification without dyeing their NRLM diesel fuel at the refinery gate. The designations will follow the fuel through the distribution system with limits placed on the ability of downstream parties to change the designation. These limits are designed to restrict the inappropriate sale of 500 ppm sulfur NRLM diesel fuel into the highway market , the inappropriate sale of heating oil into the NRLM market, the inappropriate sale of 500 ppm sulfur LM into the nonroad market, and to implement the downgrading restrictions that apply to 15 ppm sulfur highway diesel fuel. The designate and track approach includes record keeping and reporting requirements for all parties in the fuel distribution system, associated with tracking designated fuel volumes through each custodian in the distribution chain until the fuel exits the terminal. The program also includes enforcement and compliance assurance provisions to enable the Agency to rapidly and accurately review for discrepancies the large volume of data collected on fuel volume hand-offs. The bulk of the designate and track provisions end May 31, 2010 when all highway diesel fuel must meet the 15 ppm sulfur standard. However, as discussed below, scaled back designate and track provisions continue beyond 2010 for purposes of enforcing against heating oil being used in the NRLM market and to enforce against 500 ppm LM diesel fuel being used in the nonroad market.

The second adjustment that we made to the proposed NRLM diesel fuel program was to establish a 15 ppm sulfur standard at the refinery gate for locomotive and marine (LM) diesel fuel

in addition to nonroad (NR) diesel fuel.[89] We are finalizing this standard for several reasons as discussed below.

While we are finalizing a 15 ppm sulfur standard for locomotive and marine diesel fuel, we are doing so in a manner that responds to the primary concerns raised in comments regarding the need for an outlet for off-specification product. We are setting a refinery gate standard of 15 ppm sulfur beginning June 1, 2012, two years later than for nonroad diesel fuel. We are also continuing to provide an outlet for off-specification product generated in the distribution system, thereby affording the opportunity to reduce reprocessing and transportation costs. We are leaving the downstream standard for LM diesel fuel at 500 ppm sulfur. In this way the LM diesel fuel pool may remain an outlet for off-specification distillate product and interface/transmix material.

In developing the provisions of the NRLM diesel fuel program adopted today, we identified several principles that we want the program to achieve. Specifically, as described in more detail below, we believe the fuel program –

1) Achieves the greatest reduction in sulfate PM and SO_2 emissions from nonroad, locomotive, and marine diesel engines as early as practicable;

2) Provides for a smooth transition of the NRLM diesel fuel pool to 15 ppm sulfur;

3) Ensures that 15 ppm sulfur diesel fuel is produced and distributed widely for use in all 2011 and later model year nonroad diesel engines;

4) Ensures that the fuel program's requirements are enforceable and verifiable.

5) Enables the efficient distribution of all diesel fuels; and

6) Maintains the benefits and program integrity of the highway diesel fuel program.

The remainder of this section covers several topics. In section IV.A, we discuss the fuel that is covered by today's program, the standards that apply for refiners and importers (for both steps of the program), and the standards that apply for downstream entities. In section IV.B, we address the various hardship provisions that we are including in today's program. In section IV.C, we describe the special provisions that apply in the State of Alaska and the Territories. Next, in

[89] While today's program does not establish more stringent emission standards for locomotive or marine diesel engines, the Agency intends in the near future to initiate a rulemaking to adopt new emission standards for locomotive and marine engines based on the use of high efficiency exhaust emission control technology like that required for the nonroad standards adopted in today's rule. An advanced notice of proposed rulemaking (ANPRM) for this rule is published elsewhere in today's Federal Register [INSERT DATE OF PUBLICATION].

section IV.D, we describe the design of the designate and track provisions of the NRLM diesel fuel program for compliance purposes and how it differs from what we proposed. In section IV.E, we discuss the impact of today's program on state NRLM diesel fuel programs. In sections IV.F and G, we discuss the technological feasibility of the NRLM diesel fuel standards adopted today and the impacts of today's program on lubricity and other fuel properties. Finally, in section IV.H, we discuss the steps the Agency will take to streamline the refinery air permitting process for the equipment that refiners may need to install to meet today's NRLM diesel fuel standards..

Analyses supporting the design and cost of the fuel program are located in chapters 5, 7, and 8 of the RIA. Section V of this preamble discusses the details of the additional compliance and enforcement provisions affecting NRLM diesel fuel and explains various additional elements of the program.

A. Nonroad, Locomotive and Marine Diesel Fuel Quality Standards

1. What Fuel Is Covered by this Program?

The fuel covered by today's final rule is generally the same as the fuel that was covered by the proposal. We have not expanded or reduced the pool of diesel fuel that will be subject to the lower sulfur standards. However, the second step of the program now includes the same ultra low sulfur standard for locomotive and marine diesel fuel as for nonroad diesel fuel.

Specifically, the sulfur standards finalized under today's program apply to all the diesel fuel that is used in nonroad, locomotive, and marine diesel applications – fuel not already covered by the previous standards for highway diesel fuel. This includes all fuel used in nonroad, locomotive, and marine diesel engines, except for fuels heavier than a No. 2 distillate used in Category 2 and 3 marine engines[90] and any fuel that is exempted for national security or other reasons. While we are not adopting sulfur standards for other distillate fuels (such as jet fuel, heating oil, kerosene, and No. 4 fuel oil) we are adopting provisions to prevent the inappropriate use of these other fuels. Use of distillate fuels in nonroad, locomotive, or marine diesel engines will generally be prohibited unless they meet the fuel sulfur standards finalized today.[91] The program includes several provisions, as described below in section IV.D, to ensure that heating oil

[90] Category 3 marine engines frequently are designed to use residual fuels and include special fuel handling equipment to use the residual fuel.

[91] For the purposes of this final rule, the term heating oil basically refers to any No. 1 or No. 2 distillate other than jet fuel, kerosene, and diesel fuel used in highway, nonroad, locomotive, or marine applications. For example, heating oil includes fuel which is suitable for use in furnaces, boilers, stationary diesel engines and similar applications and is commonly or commercially known or sold as heating oil, fuel oil, or other similar trade names.

and other higher sulfur distillate fuels will not be used in nonroad, locomotive, or marine applications.

The regulated fuels under today's program include the following:

1) Any No. 1 and 2 distillate fuels used, intended for use, or made available for use in nonroad, locomotive, or marine diesel engines. Fuels under this category include those meeting the American Society for Testing and Materials (ASTM) D 975 or D 396 specifications for grades No. 1-D and No. 2-D. Fuels meeting ASTM DMX and DMA specifications would be covered;

2) Any No. 1 distillate fuel (e.g., kerosene) added to such No. 2 diesel fuel, e.g., to improve its cold flow properties;

3) Any other fuel used in nonroad, locomotive, or marine diesel engines or blended with diesel fuel for use in such engines. Fuels under this category include non-distillate fuels such as biodiesel and certain specialty fuel grades such as JP-5, JP-8, and F76 if used in a nonroad, locomotive, or marine diesel engine, except when a national security or research and development exemption has been approved. See V. A.1. and 2.

On the other hand, the sulfur standards do not apply to –

1) No. 1 distillate fuel used to power aircraft;

2) No. 1 or No. 2 distillate fuel used for stationary source purposes, such as to power stationary diesel engines, industrial boilers, or for heating;

3) Number 4, 5, and 6 fuels (e.g., residual fuels or residual fuel blends, IFO Heavy Fuel Oil Grades 30 and higher), used for stationary source purpose ;

4) Any distillate fuel with a T-90 distillation point greater than 700F, when used in Category 2 or 3 marine diesel engines. This includes Number 4, 5, and 6 fuels (e.g., IFO Heavy Fuel Oil Grades 30 and higher), as well as fuels meeting ASTM specifications DMB, DMC, and RMA-10 and heavier; and

5) Any fuel for which a national security or research and development exemption has been approved or fuel that is exported from the U.S. (see section V.A.1. and 2).

It is useful to clarify what marine diesel fuels are covered by the sulfur standards. As with nonroad and locomotive diesel fuel, our basic approach is that the standards apply to any diesel or distillate fuel used or intended for use in marine diesel engines. However, the fuel used by marine diesel engines spans a wide variety of fuels, ranging from No. 1 and 2 diesel fuel to residual fuel

and residual fuel blends used in the largest engines. It is not EPA's intention to cover all such fuels, and EPA has adopted an objective criteria to identify those marine fuels subject to regulation and those that are not. Any distillate fuel with a T-90 greater than 700F will not be subject to the sulfur standards when used in Category 2 or 3 marine engines. This criteria is designed to exclude fuels heavier than No. 2 distillate, including blends containing residual fuel. In addition, residual fuel is not subject to the sulfur standards.

While many marine diesel engines use No. 2 distillate, ASTM specifications for marine fuels identify four kinds of marine distillate fuels: DMX, DMA, DMB, and DMC. DMX is a special light distillate intended mainly for use in emergency engines. DMA (also called MGO) is a general purpose marine distillate that is to contain no traces of residual fuel. These fuels can be used in all marine diesel engines but are primarily used by Category 1 engines. DMX and DMA fuels intended for use in any marine diesel engine are subject to the fuel sulfur standards.

DMB, also called marine diesel oil, is not typically used with Category 1 engines, but is used for Category 2 and 3 engines. DMB is allowed to have a trace of residual fuel, which can be high in sulfur. This contamination with residual fuel usually occurs due to the distribution process, when distillate is brought on board a vessel via a barge that has previously contained residual fuel, or using the same supply lines as are used for residual fuel. DMB is produced when fuels such as DMA are brought on board the vessel in this manner. EPA's sulfur standards will apply to the distillate that is used to produce the DMB, for example the DMA distillate, up to the point that it becomes DMB. DMB itself is not subject to the sulfur standards when it is used in Category 2 or 3 engines.

DMC is a grade of marine fuel that may contain some residual fuel and is often a residual fuel blend. This fuel is similar to NO. 4 diesel, and can be used in Category 2 and Category 3 marine diesel engines. DMC is produced by blending a distillate fuel with residual fuel, for example at a location downstream in the distribution system. EPA's standards will apply to the distillate that is used to produce the DMC, up to the point that it is blended with the residual fuel to produce DMC. DMC itself is not subject to the sulfur standards when it is used in Category 2 or 3 marine engines.

Residual fuel is typically designated by the prefix RM (e.g., RMA, RMB, etc.). These fuels are also identified by their nominal viscosity (e.g., RMA10, RMG35, etc.). Most residual fuels require treatment by a purifier-clarifier centrifuge system, although RMA and RMB do not require this. For the purpose of this rule, we consider all RM grade fuel as residual fuel. Residual fuel is not covered by the sulfur content standards as it is not a distillate fuel.

The distillation criteria adopted by EPA, T-90 greater than 700F, is designed to identify those fuels that are not subject to the sulfur standards when used in Category 2 or 3 marine diesel engines. It is intended to exclude DMB, DMC, and other heavy distillates or blends, when used in Category 2 or 3 marine diesel engines.

Hence, the fuel that refiners and importers are required to produce to the more stringent sulfur standards include those No. 1 and No. 2 diesel fuels as well as similar distillate or non-distillate fuels that are intended or made available for use in NRLM diesel engines. Furthermore, the sulfur standard also covers any fuel that is blended with or substituted for No. 1 or No. 2 diesel fuel for use in nonroad, locomotive, or marine diesel engines. For instance, as required under the highway diesel fuel program, in those situations where the same batch of kerosene is distributed for two purposes (e.g., kerosene to be used for heating and to improve the cold flow of No. 2 NRLM diesel fuel), or where a batch distributed just for heating is later distributed for blending with No. 2 diesel fuel, that batch of kerosene must meet the standards adopted today for NRLM diesel fuel. The purpose of this requirement is to ensure that fuels like jet fuel, kerosene, and/or military specification fuels meet the diesel fuel sulfur standards adopted under today's program when they are used in nonroad, locomotive, or marine diesel engines.

2. Standards and Deadlines for Refiners and Importers

The NRLM diesel fuel program adopted today is a two-step approach to reduce the sulfur content of NRLM diesel fuel from uncontrolled levels down to 15 ppm sulfur. While we received several comments supporting a single step down to 15 ppm sulfur, the vast majority of commenters, especially most refiners and engine manufacturers, supported the two-step approach. We are finalizing the two-step approach primarily because it achieves the greatest reduction in sulfate PM and SO_2 emissions from nonroad, locomotive, and marine diesel engines as early as practicable. By starting with an initial step of 500 ppm sulfur we can achieve significant emission reductions and associated health and welfare benefits from the current fleet of equipment as soon as possible. As discussed in section VI, the health-related benefits of the fuel standards finalized today, even without the engine standards, amount to more than $28 billion in 2030, while the projected costs, after taking into account engine maintenance benefits amount to just $0.7 billion.

In addition, the two-step approach encourages a more smooth and orderly transition by the refining industry to 15 ppm sulfur NRLM diesel fuel, by providing more time for refiners to develop the most cost-effective approaches, finance them, and then implement the necessary refinery modifications.

Finally, by waiting until 2010 to drop to the 15 ppm sulfur standard for NR diesel fuel, the two-step approach harmonizes with the highway diesel fuel program by delaying the implementation of the 15 ppm sulfur standard for NR diesel fuel until the end of the phase-in period for 15 ppm sulfur highway diesel fuel. The 2010 date also harmonizes with the date 15 ppm nonroad fuel is needed to enable the nonroad engines standards finalized today. The second step to 15 ppm sulfur for the LM diesel fuel is set for 2012. On balance we believe that the advantages of the two-step approach outweigh those of a single step down to 15 ppm.

As discussed in section IV.C, below, later deadlines for meeting the 500 and 15 ppm sulfur standards apply to refineries covered by special hardship provisions as well as transmix processors.

a. The First Step to 500 ppm Sulfur NRLM Diesel Fuel

Under today's program, NRLM diesel fuel produced by refiners or imported into the U.S. by importers must meet a 500 ppm sulfur standard beginning June 1, 2007. Refiners and importers may comply by either producing such fuel at or below 500 ppm sulfur, or they may comply by obtaining credits as discussed in section IV.D below.

We believe that the adopted level of 500 ppm sulfur is appropriate for several reasons. First, the reduction to 500 ppm sulfur is significant environmentally. The 500 ppm sulfur level achieves approximately 90 percent of the sulfate PM and SO_2 benefits otherwise achievable by going all the way to 15 ppm sulfur. Second, because this first step is only to 500 ppm sulfur, it also allows for a short lead time for implementation, enabling the environmental benefits to begin accruing as soon as possible. Third, it is consistent with the current specification for highway diesel fuel, a grade which may remain for highway purposes until 2010. As such, adopting the same 500 ppm sulfur level for NRLM diesel fuel helps to avoid issues and costs associated with more grades of fuel in the distribution system during this initial step of the program.

b. The Second Step to 15 ppm Sulfur NRLM Diesel Fuel

We are finalizing a second step of sulfur control down to 15 ppm sulfur for all NRLM. This second step provides additional important direct sulfate PM and SO_2 emission reductions and associated health benefits. As discussed in the RIA, the health related benefits for this second step of fuel control by itself are greater than the associated cost. Furthermore, the second step for nonroad diesel fuel is essential to enable the application of high efficiency exhaust emission control technologies to nonroad diesel engines beginning with the 2011 model year as discussed in Section II of this preamble.

In the proposal, the second step of the program only applied to nonroad diesel fuel, while locomotive and marine diesel fuel could remain at 500 ppm sulfur. We also sought comment on finalizing the 15 ppm sulfur standard for LM diesel fuel in 2010 along with nonroad diesel fuel, as well as delaying it until as late as 2012 to allow for an additional outlet for any off-specification product a refinery might produce as it shifts all of its distillate production to 15 ppm sulfur.[92]

We are finalizing the 15 ppm sulfur standard for locomotive and marine diesel fuel, along with nonroad diesel fuel, for several reasons. First, it will provide important health and welfare benefits from the additional sulfate PM and SO_2 emission reductions as early as possible. Second, it is technologically feasible, as it is for nonroad diesel fuel. Third, the benefits outweigh the costs and the costs do not otherwise warrant delaying this second step for locomotive and marine. As

[92] Off-specification fuel here refers to 15 ppm diesel fuel that becomes contaminated such that it no longer meets the 15 ppm sulfur cap. In most cases, off-specification 15 ppm sulfur diesel fuel is expected to easily meet a 500 ppm sulfur cap.

shown in chapter 8 of the RIA, the costs for the increment of LM diesel fuel going from 500 to 15 ppm sulfur is just $0.20 billion in 2030. Fourth, it will simplify the fuel distribution system and overall design of the fuel program. For example, the addition of a marker to locomotive and marine diesel fuel after 2012 is no longer necessary to successfully enforce the program. Finally, it will allow refiners to coordinate plans to reduce the sulfur content of all of their off-highway diesel fuel at one time.

Our primary reason in the NPRM for leaving locomotive and marine diesel fuel at the 500 ppm sulfur specification was to preserve an outlet for off-specification product that may be created in the distribution system through contamination of 15 ppm sulfur diesel fuel with higher sulfur distillates and for off-specification batches of fuel that are produced by refineries during the first couple years of the 15 ppm sulfur program (when they are still perfecting their production processes). However, we have concluded that it is not necessary to leave the standard for all locomotive and marine diesel fuel at the 500 ppm sulfur specification to address these concerns. Setting a 15 ppm sulfur standard for refiners and importers in 2012, but maintaining a downstream standard for locomotive and marine diesel fuel at 500 ppm sulfur and allowing off-specification product to continue to be sold into this market accomplishes the same goal.

In addition, controlling the sulfur content of NRLM diesel fuel from uncontrolled levels to 15 ppm is clearly a cost-effective fuel control program. While the incremental cost-effectiveness from 500 ppm sulfur to 15 ppm sulfur is less cost-effective, the benefits of this second step outweigh the costs, the concerns about a market for off-specification product have been addressed, and other factors discussed above support the reasonableness of this approach. The body of evidence strongly supports the view that controlling sulfur in NRLM fuel to 15 ppm, through a two-step process, is quite reasonable in light of the emissions reductions achieved, taking costs into consideration.

Implementation of today's rule will reduce the sulfur level of almost all distillate fuel to a 15 ppm maximum sulfur level. In addition to the small refiner, hardship, and other provisions adopted in this rule, EPA is adopting several provisions that will help ensure a smooth transition to the second step of 15 ppm sulfur diesel fuel. First, refiners and importers of locomotive and marine diesel fuel, a small segment of the entire distillate pool, will be required to meet a 15 ppm sulfur standard starting June 1, 2012, two years later than for nonroad diesel fuel. Second, 500 ppm sulfur diesel fuel generated in the distribution system through contamination of 15 ppm sulfur fuel can be marketed in the nonroad, locomotive and marine market until June 2014, and in the locomotive and marine market after that date. Third, 500 ppm sulfur diesel fuel produced by transmix processors from contaminated downstream diesel fuel can also be marketed to the nonroad, locomotive and marine markets, under the same schedule. While today's rule does not contain an end date for the downstream distribution of 500 ppm sulfur locomotive and marine fuel, we will review the appropriateness of allowing this flexibility based on experience gained from implementation of the 15 ppm sulfur NRLM diesel fuel standard. We expect to conduct such an evaluation in 2011.

When EPA adopted a 15 ppm sulfur standard for highway diesel fuel, we included several provisions to ensure a smooth transition to 15 ppm sulfur highway fuel. One provision was a temporary compliance option, with an averaging, banking and trading component. In a similar manner, the 2012 deadline for 15 ppm sulfur LM fuel, the last, relatively small segment of diesel fuel, will help ensure that the entire pool of diesel fuel is smoothly transitioned to the 15 ppm sulfur level over a short period of time. (See section 8.3 of the summary and analysis of comments.)

EPA is also adopting two provisions aimed at smoothing the transition of the distribution system to ultra low sulfur diesel fuel. These provisions are designed to accommodate off-specification fuel generated in the distribution system, such as through the mixing that occurs at product interfaces. This off-specification material generally cannot be added in any significant quantity to either of the adjoining products that produced the interface.[93] Under today's program, as discussed in more detail in section A.3, below, off-specification material that is generated in the distribution system may be distributed as 500 ppm NRLM diesel fuel from June 1, 2010 through May 31, 2014 and as 500 ppm LM from June 1, 2014 and beyond. Furthermore, as discussed in section IV.C, below, transmix processors, which are facilities that process transmix by separating it into its components (e.g., separating gasoline from diesel fuel), are treated as a separate class of refiners. One hundred percent of the diesel fuel they produce from transmix may be sold as high sulfur NRLM until June 1, 2010, 500 ppm sulfur NRLM until June 1, 2014, and 500 ppm sulfur LM diesel fuel after June 1, 2014.

These provisions provide refiners and importers with a similar degree of flexibility for off-specification product as the proposal which held the sulfur standard for all locomotive and marine diesel fuel at 500 ppm indefinitely. If off-specification product is produced, there is a temporary outlet for it. If providing the off-specification product to a locomotive and marine market is difficult under this final rule, such that a refiner will choose to re-process it, then the refiner would have been in the same position under the proposal. Furthermore, these provisions provide the refining industry an alternative to reprocessing the off-specification material created in the distribution system, which preserves refining capacity for the production of new fuel volume, helping to maintain overall diesel fuel supply.

As with the 500 ppm sulfur standard under the first step of today's program, refiners and importers may comply with the 15 ppm sulfur standard by either producing NRLM diesel fuel containing no more than 15 ppm sulfur or by obtaining sulfur credits (until June 1, 2014), as described below.

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[93] In some cases the off-specification product can not be added to the adjoining products because of the applicable sulfur standards. In other cases, the off-specification product, called transmix, must be re-processed before it can be used.

c. Cetane Index or Aromatics Standard

Currently, in addition to containing no more than 500 ppm sulfur, highway diesel fuel must meet a minimum cetane index level of 40 or, as an alternative, contain no more than 35 volume percent aromatics. Today's program extends this cetane index/aromatics content specification to NRLM diesel fuel.

One refining company commented that EPA should not implement the cetane index and aromatic requirements in the proposed rule since the impacts are weak or nonexistent for engines to be used in the future. In addition, the commenter stated that the vast majority of diesel fuel already meets the EPA cetane index/aromatics specification for highway diesel fuel and that there is nothing in the RIA that either demonstrates the benefits or supports the need for such a requirement. The commenter also stated that EPA should not set a requirement simply because the ASTM standard has a cetane number specification for a particular fuel.

Low cetane levels are associated with increases in NO_X and PM emissions from current nonroad diesel engines.[94] Thus, we expect that extending the cetane index specification to NRLM diesel fuel will directionally lead to a reduction in these emissions from the existing fleet. However, because the vast majority of NRLM diesel fuel already meets the specification, the NO_X and PM emission reductions will be small. At the same time, the refining/production costs associated with extending the cetane index specification to NRLM diesel fuel are negligible as current NRLM diesel fuel already meets a more stringent ASTM specification.

ASTM already recommends a cetane number specification of 40 for NRLM diesel fuel, which is, in general, more stringent than the similar 40 cetane index specification. Because of this, the vast majority of current NRLM diesel fuel already meets the EPA cetane index/aromatics specification for highway diesel fuel. Thus, the cetane index specification will impact only a few refiners and there will be little overall cost associated with producing fuel to meet the cetane/aromatic requirement. In fact, as discussed in chapter 5.9 of the RIA, compliance with the sulfur standards adopted today is expected to result in a small cetane increase as increases in cetane correlate with decreases in sulfur, leaving little or no further control to meet the standard.

While the emissions benefits and refining/production costs of extending the specification to NRLM diesel fuel may be small, the extension will reduce costs by giving refiners and distributors the ability to fungibly distribute highway and NRLM diesel fuels of like sulfur content. For that small fraction of NRLM diesel fuel today that does not meet the cetane index or aromatics specification, the requirement will eliminate the need for refiners and fuel distributors to separately distribute fuels of different cetane/aromatics specifications. Requiring NRLM diesel fuel to meet this cetane index specification thus gives fuel distributors certainty in being able to combine shipments of highway and NRLM diesel fuels. Perhaps more importantly, it can also

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[94] *The Effect of Cetane Number Increase Due to Additives on NO_X Emissions from Heavy-Duty Highway Engines, Final Technical Report*, February 2003, EPA420-R-03-002.

give engine manufacturers and end-users the confidence they need that their fuel will meet the minimum cetane or maximum aromatics standard. Given the inherent difficulty in segregating two otherwise identical fuels, were we not to carry over these standards to NRLM, lower cetane NRLM could easily find its way into current highway engines. If not designed for this lower cetane fuel, these engines could have elevated emission levels and performance problems.

Overall, we believe that there will be a small reduction in NO_X and PM emissions from current engines and the economic benefits from more efficient fuel distribution will likely exceed the cost of raising the cetane level for the small volume of NRLM diesel fuel that does not already meet the cetane index or aromatics content specification.

3. Standards, Deadlines, and Flexibilities for Fuel Distributors

The first years of the NRLM diesel fuel program include various flexibilities to smooth the refining and distribution industry's transition to 15 ppm sulfur fuel. These flexibilities include a 2012 deadline for production of 15 ppm sulfur locomotive and marine diesel fuel, credit provisions, small refiner provisions, hardship provisions, and downstream off-specification fuel provisions. As a result, during the transition years, we are not able to simply enforce the sulfur standards downstream based on a single sulfur level of the new standard. From June 1, 2007 through May 31, 2010, both 500 ppm sulfur diesel fuel and high sulfur diesel fuel can be produced, distributed, and sold for use in NRLM diesel engines. From June 1, 2010 through May 31, 2014, both 15 ppm sulfur and 500 ppm sulfur diesel fuel can be produced, distributed, and sold for use in NRLM diesel engines. Beyond June 1, 2014, both 15 ppm sulfur and 500 ppm sulfur diesel fuel that is produced from fuel product downgrade and transmix in the distribution system can be distributed and sold for use in locomotive and marine diesel engines. As these transition flexibilities expire, however, we are able to streamline our downstream enforcement provisions.

a. Standards and Deadlines from June 1, 2007 through May 31, 2010

As soon as the program begins on June 1, 2007, all NRLM diesel fuel must be designated or classified and must comply with the designation or classification stated on its product transfer document (PTD), pump label, or other documentation. In other words, if the fuel is intended for sale as NRLM diesel fuel and is labeled as 500 ppm sulfur diesel fuel, then beginning June 1, 2007, it must comply with the 500 ppm sulfur standard. Similarly, if fuel is intended for sale as NRLM diesel fuel and is labeled as 15 ppm sulfur, then beginning June 1, 2010 (or June 1, 2009 under the early credit provisions), it must comply with the 15 ppm sulfur standard.

Beginning June 1, 2010, all NRLM diesel fuel produced or imported is required to meet at least a 500 ppm sulfur limit. In order to allow for a smooth and orderly transition to 500 ppm sulfur NRLM diesel fuel in the distribution system, and allow any remaining high sulfur fuel to be sold, we are providing parties downstream of refineries time to turnover their NRLM tanks to 500 ppm sulfur diesel fuel. At the terminal level, all NRLM diesel fuel must meet at least the 500

ppm sulfur standard beginning August 1, 2010. At any wholesale purchaser-consumer facilities and any retail stations carrying NRLM diesel fuel, including bulk plants that serve as retailers, all diesel fuel must meet the 500 ppm sulfur standard beginning October 1, 2010.[95] Thus, beginning October 1, 2010, high sulfur (greater than 500 ppm sulfur) NRLM diesel fuel may no longer legally exist in the fuel distribution system.[96]

Although we expect that most NRLM diesel fuel in the distribution system will be subject to the 500 ppm sulfur standard during the period from June 1, 2007 through May 31, 2010, based on its designation or classification, some of the 500 ppm sulfur NRLM diesel fuel may be mixed with high sulfur NRLM diesel fuel. Since the blended product will likely no longer meet the 500 ppm sulfur standard, it must be re-designated and labeled as high sulfur NRLM diesel fuel. Similarly, fuel that results from blending 500 ppm sulfur NRLM diesel fuel and heating oil must be re-designated and labeled as heating oil.

b. Standards and Deadlines from June 1, 2010 through May 31, 2014

Beginning June 1, 2010, most NR diesel fuel will be required to meet the 15 ppm sulfur standard, and beginning June 1, 2012, most LM diesel fuel will be required to meet the 15 ppm sulfur standard. However, some production of 500 ppm sulfur NRLM diesel fuel may continue through May 31, 2014. As with the delayed downstream compliance dates for the 500 ppm sulfur standard under the first step of today's program, parties downstream of refineries will be allowed additional time to turnover their tanks to 15 ppm sulfur NR diesel fuel. Specifically, at the terminal level, all NR diesel fuel will be required to meet the 15 ppm sulfur standard beginning August 1, 2014. At any wholesale purchaser-consumer facilities and retail stations carrying all NR diesel fuel, including bulk plants serving as retailers, NR diesel fuel must meet the 15 ppm sulfur standard beginning October 1, 2014. Thus, beginning October 1, 2014, 500 ppm sulfur NR diesel fuel may no longer legally exist in the fuel distribution system.[97]

Like the first step to 500 ppm sulfur, prior to these 2014 downstream deadlines all NRLM diesel fuel would still be designated or classified with respect to sulfur level and required to meet the designation or classification stated on its PTD, pump label, or other documentation.

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[95] A bulk plant is a secondary distributor of refined petroleum products. They typically receive fuel from terminals and distribute fuel in bulk by truck to end users. Consequently, while for highway fuel, bulk plants often serve the role of a fuel distributor, delivering fuel to retail stations, for nonroad fuel, they often serve the role of the retailer, delivering fuel directly to the end-user.

[96] By December 1, 2010, all NRLM diesel fuel, including fuel in end-user tanks, must comply with at least the 500 ppm sulfur standard.

[97] By December 1, 2014, all NR diesel fuel, including fuel in end-user tanks, must comply with at least the 15 ppm sulfur standard.

c. Sulfur Standard for NRLM Diesel Fuel Beginning June 1, 2014

As discussed above, all refiners will be required to produce and importers will be required to import only 15 ppm sulfur NRLM diesel fuel by June 1, 2014. However, we will continue to allow 500 ppm sulfur diesel fuel to be sold into the LM diesel fuel markets beyond 2014. The LM diesel fuel markets are expected to provide a valuable outlet for higher sulfur distillate fuel produced in the distribution system, at least through the early years of the program. Consequently, beyond 2014, both 15 ppm sulfur and 500 ppm sulfur LM diesel fuel may continue to exist in the distribution system, and each fuel must comply with the designation stated on its PTD, pump label, or other documentation.

d. Interface/Transmix Flexibility for Fuel Distributors

As described above, today's program provides flexibility to the distribution system by allowing interface/transmix material generated within the distribution system to be sold into the NRLM diesel fuel markets. Specifically, any fuel interface/transmix generated in the fuel distribution system may be sold as

1) high sulfur NRLM diesel fuel or heating oil from June 1, 2007 through May 31, 2010;
2) 500 ppm sulfur NRLM diesel fuel or heating oil from June 1, 2010 through May 31, 2014; or
3) 500 ppm sulfur LM diesel fuel or heating oil after June 1, 2014.

Hence, beginning June 1, 2014, interface/transmix material exceeding 15 ppm sulfur may only be sold into the LM diesel fuel or heating oil markets. As discussed above, the downstream standard for LM diesel fuel will be 500 ppm sulfur. However, heating oil may not be shifted into the LM markets. Parties in the distribution system receiving diesel fuel with a sulfur content greater than 15 ppm sulfur must maintain records and report to EPA information demonstrating that they did not shift heating oil into the LM markets, as discussed in section IV.D.

The generation of greater than 15 ppm sulfur distillate fuel from pipeline interface/transmix cannot be avoided due to the physical realities of a multi-product fuel distribution system. Such fuel first appears at the terminus of the pipeline distribution system; at terminals due to the generation of segregated interface, or at transmix processing facilities.[98] In areas where there is a strong demand for heating oil, much of this pipeline-generated off-specification fuel can be sold into the heating oil market, just as it is today. However, in many

[98] Segregated interface refers to the mixing zone between two batches of fuel that abut each other in the pipeline, where the volume in the mixing zone can not be cut into either of the fuel batches, but can still meet another fuel product specification without reprocessing, provided that it is drawn off of the pipeline separately and segregated.

areas of the country the demand for heating oil would not be sufficient to accommodate distillate fuel exceeding 15 ppm sulfur that is generated in the pipeline. Therefore, such fuel would need to be returned to a refinery for reprocessing to meet a 15 ppm sulfur standard. In addition, some refiners may be reluctant to accept such material for reprocessing given the impact this would have on their refinery operations. More importantly, because such material appears at the terminus of the pipeline distribution system and often where no access to pipeline or marine shipment is available, it would have to be shipped back to a refinery by truck, or rail if available, at additional cost.

As discussed in chapter 7 of the RIA, fuel generated from such interface/transmix will typically meet a 500 ppm sulfur standard. Therefore, allowing the continued use of such 500 ppm sulfur diesel fuel in locomotive and marine engines could reduce the burden on the fuel distribution industry by lowering costs. Our cost estimates of marketing such fuel include additional shipping charges for situations where there is not a local locomotive or marine market (see section VI of this preamble).[99] Allowing the continued sale of 500 ppm sulfur diesel fuel into the locomotive and marine markets without requiring it to be reprocessed will also help preserve refining capacity for the overall diesel fuel production. Therefore, this provision also serves to address lingering concerns expressed by some refiners regarding the impacts of the 15 ppm sulfur standard for highway and NRLM diesel fuel on overall diesel fuel supply.

Downstream-generated 500 ppm sulfur diesel fuel may only be used in nonroad engines until December 1, 2014, due to concerns regarding enforceability and the increased potential for misfueling of nonroad equipment (equipment with advanced emission controls). Beginning with the 2011 model year, such equipment will require the use of 15 ppm sulfur diesel fuel to operate properly. The same concerns do not exist regarding the continued use of such 500 ppm sulfur diesel fuel in locomotive and marine engines for three reasons. First, locomotive and marine engines are not currently required to be equipped with the sulfur sensitive emissions aftertreatment that will start being used on nonroad equipment in 2011.[100] Second, locomotive

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[99] As mentioned above, the Agency intends in the near future to initiate a rulemaking to adopt new emission standards for locomotive and marine engines. An advanced notice of proposed rulemaking (ANPRM) for this rule is published elsewhere in today's Federal Register [INSERT DATE OF PUBLICATION]. While we are not finalizing a sunset date for this downgrade provision in today's final rule, we are evaluating the appropriateness of establishing a sunset date on this provision in the context of the subsequent engine standards rule. We also intend to review the appropriateness of any sunset provision in light of experience gained from implementation of the 15 ppm sulfur NRLM diesel fuel standard. We would conduct such an evaluation in 2011.

[100] Although, as mentioned above, the Agency intends in the near future to initiate a rulemaking to adopt new emission standards for locomotive and marine engines. An advanced notice of proposed rulemaking (ANPRM) for this rule is published elsewhere in today's Federal Register [INSERT DATE OF

and marine markets are centrally fueled to a much greater extent than nonroad markets, and thus enforceability is not as significant of an issue. Finally, we believe the program's designate and track provisions discussed below will be sufficient to enforce the limits on production and use of 500 ppm sulfur diesel fuel.

It is difficult to project exactly how much of this downstream generated downgraded fuel could be segregated and shipped to LM markets. However, it is clear that this provision represents an important flexibility for the distribution system. In fact, it provides virtually the same flexibility as provided by the proposal to handle off-specification product. In both cases, use of the flexibility is dependent on the ability to segregate the interface and transport it to available LM markets. While today's rule does not contain an end date for the downstream distribution of 500 ppm sulfur locomotive and marine fuel, we will review the appropriateness of allowing this flexibility based on experience gained from implementation of the 15 ppm sulfur NRLM diesel fuel standard. We expect to conduct such an evaluation in 2011.

A summary of the NRLM sulfur levels and final deadlines for refiners, importers, terminals, and other downstream parties is shown in table IV-1 below.

Table IV-1. – 500 ppm Sulfur and 15 ppm Sulfur NRLM Final Compliance Dates

	Refiners and Importers	**Credit, Small Refiner**	**Terminals**	**Bulk Plants, Wholesale Purchaser-Consumers and Retail Outlets**	**Other Locations**
500 ppm NRLM	June 1, 2007	June 1, 2010	August 1, 2010	October 1, 2010	December 1, 2010
15 ppm NR	June 1, 2010	June 1, 2014	August 1, 2014	October 1, 2014	December 1, 2014
15 ppm LM	June 1, 2012	June 1, 2014	-	-	-

4. Diesel Sulfur Credit Banking and Trading Provisions

Today's final program includes provisions for refiners and importers to generate early credits for the production of 500 ppm sulfur NRLM diesel fuel prior to June 1, 2007 and for the production of 15 ppm sulfur NRLM diesel fuel prior to June 1, 2010. These credit banking and trading provisions will provide implementation flexibility by facilitating a somewhat smoother transition at the start of the program in 2007, with some refineries/import facilities complying

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early, others on time, and others a little later. These credit banking and trading provisions may also facilitate some of the environmental benefits of the program being achieved earlier than otherwise required, and may increase the overall environmental benefits of the program. As discussed below, overall benefits will accrue if refiners produce 500 ppm earlier in lieu of high sulfur NRLM and then bank those credits to continue producing 500 ppm sulfur NR diesel fuel in 2010 or 500 ppm LM diesel fuel in 2012 in lieu of 15 ppm.[101]

Specifically, credits generated under the NRLM diesel fuel program may be banked and later used to delay compliance with either the 500 ppm sulfur NRLM standard that begins in 2007, the 15 ppm sulfur NR standard that begins in 2010, or the 15 ppm sulfur LM standard that begins in 2012. Credits may also be traded within companies such that credits generated at one refinery/import facility in a given company may be traded to another refinery/import facility within that same company. In addition, refiners or importers may purchase credits generated by other refiners or importers to meet the program requirements. Finally, and perhaps most importantly, individual refineries/import facilities may be able to use credits to permit the continued sale of otherwise off-specification product at the beginning of the program's second step when they are still adjusting their operations for consistent production/importation of NRLM diesel fuel that is subject to the new sulfur standards.

a. Credit Generation from June 1, 2006 through May 31, 2007

Credits may be generated under today's program to allow for the production of high sulfur NRLM diesel fuel after June 1, 2007. A refiner or importer may obtain credit for early production/importation of fuel meeting the 500 ppm sulfur standard that they designate as NRLM diesel fuel, from June 1, 2006 through May 31, 2007. In addition, small refiners may also generate credits for the early production of 500 ppm sulfur diesel fuel that they designate as NRLM diesel fuel. As described in section IV.B, below, small refiners are not required to produce any 500 ppm sulfur NRLM diesel fuel until June 1, 2010. Those small refiners who choose to comply with the 500 ppm sulfur standard earlier than required, that is before June 1, 2010, may generate credits for any volume of diesel fuel they produce from June 1, 2007 through May 31, 2010 and designate as NRLM. Credits for the early production of 500 ppm sulfur fuel (including by small refineries) are fungible, may be banked for future use, or traded to any other refiner or importer nationwide. In order to ensure that these early credits are real and not merely shifts from the highway market, both early credits and small refinery credits will be subject to a limit determined by the following formula:

$$Credit_{HS} = (Vol_{15} + Vol_{500}) - Vol_{hwy}$$

[101] We are not adopting specific provisions to generate credits for early production of LM diesel fuel prior to June 1, 2012. The difference in start date between 2010 and 2012 already provides additional flexibility to producers of LM diesel fuel, and setting separate credit generation periods for NR and LM diesel fuel would unnecessarily complicate the compliance assurance provisions.

$$Credit_{HS}\ Limit = (Vol_{15} + Vol_{500}) - Base_{hwy}$$

Where:

$Credit_{500}$ Limit	=	Limit for 500 ppm NRLM credits
$Credit_{HS}$	=	High-Sulfur NRLM credits[102]
Vol_{15}	=	Volume of 15 ppm sulfur diesel fuel produced and designated as highway or NRLM
Vol_{500}	=	Volume of 500 ppm sulfur diesel fuel produced and designated as highway or NRLM
$Base_{hwy}$	=	2003-2005 highway diesel fuel baseline volume
Vol_{hwy}	=	Volume of diesel fuel produced and designated as highway

If the excess production is 15 ppm sulfur diesel fuel instead of 500 ppm sulfur diesel fuel, then the refiner will have the option of generating 500 ppm sulfur credits under the highway diesel fuel program. Credit may not be earned under both programs for a given volume of 500 ppm sulfur or 15 ppm sulfur diesel fuel.

b. Credit Generation from June 1, 2009 through May 31, 2010

In addition to allowing credit for the early production of 500 ppm sulfur NRLM diesel fuel, today's program also allows credit for the early production of 15 ppm sulfur NRLM diesel fuel. Specifically, refiners and importers may obtain credit for early production/importation of fuel meeting the 15 ppm sulfur standard and that they designate as NRLM from June 1, 2009 through May 31, 2010. In addition, small refiners, which are not required to produce any 15 ppm sulfur NRLM diesel fuel until June 1, 2014, may also generate credits for the early production of any volume of 15 ppm sulfur diesel fuel that they designate as NRLM from June 1, 2010 through December 31, 2013. Again, these early credits are fungible, may be banked for future use, or traded to any other refinery or importer nationwide. However, in order to ensure these credits are real and not merely shifts from the highway market, credits for the early production or importation of 15 ppm sulfur fuel will be subject to a limit determined by the following formula:

$$Credit_{500} = Vol_{15} - Vol_{15hwy}$$

$$Credit_{500}\ Limit = Vol_{15} - Base_{15hwy}$$

Where:

[102] For the purposes of this rule, credits are labeled on the basis of their use in order to follow the convention used in the highway diesel rule. A high-sulfur credit is generated through the production of one gallon of 500 ppm sulfur NRLM diesel fuel and allows the production of one gallon of high sulfur NRLM diesel fuel.

$Credit_{500}$ Limit =	Limit for 500 ppm sulfur NRLM credits	
Vol_{15}	=	Volume of 15 ppm sulfur diesel fuel produced and designated as highway or NRLM
$Base_{15hwy}$	=	2006-2008 15 ppm sulfur highway diesel fuel baseline volume

Hence, to generate credits, a refiner or importer's highway diesel fuel volume for the compliance period must be greater than or equal to the baseline volume. That is, a refiner or importer may only generate credits for "new" volumes of 15 ppm sulfur diesel fuel that it produces. If their highway diesel fuel volume were to drop below the baseline volume, that would likely indicate a shift in production from the highway market to generate 15 ppm sulfur NRLM diesel fuel credits.

c. Credit Use

There are two ways in which refiners or importers may use high-sulfur NRLM credits under the NRLM diesel fuel program. First, credits may be used during the period from June 1, 2007 through May 31, 2010 to continue to produce high sulfur NRLM diesel fuel. Any high sulfur NRLM diesel fuel that is produced, however, must be designated and labeled as such for tracking purposes throughout the distribution system and be dyed red at the refinery gate.

The second way in which refiners and importer could use high-sulfur NRLM credits is by banking them for use during the June 1, 2010 through May 31, 2014 period. Credits used in this manner would provide a net environmental benefit, since they were generated by reducing the sulfur level from approximately 3000 ppm to less than 500 ppm (a net change of 2500 ppm sulfur), but when used only allow the sulfur level to increase from 15 ppm to 500 ppm (a net change of less than 500 ppm sulfur). 500 ppm sulfur credits generated from the early production of 15 ppm sulfur NRLM diesel fuel may also be used from June 1, 2010 through May 31, 2014. Thus, during this period, when the 15 ppm sulfur standard is in effect for nonroad diesel fuel, refiners/importers may use either high sulfur credits or 500 ppm sulfur credits to continue producing/importing 500 ppm sulfur nonroad diesel fuel. Any 500 ppm sulfur diesel fuel that is produced, however, must be appropriately designated and labeled for tracking purposes throughout the distribution system, and cannot be sold for use in 2011 and later model year nonroad engines. From June 1, 2012, when the 15 ppm sulfur standard for LM diesel fuel becomes effective, through May 31, 2014, refiners/importers may use either high sulfur credits or 500 ppm sulfur credits to continue producing/importing 500 ppm sulfur NRLM diesel fuel. All credits expire after May 31, 2014. Hence, beginning June 1, 2014, all NRLM diesel fuel produced by refiners or imported in the U.S. will be subject to the 15 ppm sulfur standard, except LM diesel fuel produced by transmix processors from transmix can continue to meet the 500 ppm sulfur limit.

We proposed that all credits would expire May 31, 2012, however we are finalizing an expiration date of May 31, 2014 based on the comments we received. The additional two years

that we are now allowing for credit use 1) will provide a longer period for refiners to sell off-specification fuel instead of having to reprocess it, 2) is an environmentally neutral change to the overall program, and 3) is now consistent with the end-date for small refiner flexibility.

While credits can be generated and traded nationwide, they are restricted from use in certain parts of the country under the provisions of this final rule. As discussed in section IV.D, we are avoiding the burden to terminals of adding marker to heating oil in those areas of the country where demand for heating oil is expected to continue to remain high after today's final rule. The NRLM diesel fuel sulfur standards will be enforced based on sulfur level in these areas, not through the refinery designation and marker provisions. Consequently, in the area defined in section IV.D comprising most of the Northeast and Mid-Atlantic region of the country, as well as in the State of Alaska, many of the fuel program's flexibilities, including refiners' ability to use credits, are not allowed. Refiners and importers may not use credits to produce or import diesel fuel with a sulfur content greater than 500 ppm beginning June 1, 2007 or 15 ppm beginning June 1, 2010, for sale or distribution in this Northeast/Mid-Atlantic area or the State of Alaska. However, credits generated in these areas can be sold to other refiners and/or importers for use outside these areas.

B. Hardship Relief Provisions for Qualifying Refiners

As in our gasoline sulfur and highway diesel fuel sulfur programs, today's program contains the following hardship relief provisions to provide regulatory flexibility to challenged refiners:

- Small refiner hardship for qualifying small refiners;
- General hardship for any refiner experiencing either -
  1) extreme unforeseen circumstances such as natural disaster or acts of God; or
  2) extreme hardship circumstances such as financial or technical hardship.

Similar provisions have proved invaluable for some refiners in the recent implementation of the gasoline sulfur standards, as well as for refiners' planning for the highway diesel standards. The details of these provisions are discussed below.

1. Hardship Provisions for Qualifying Small Refiners

As in previous fuel rulemakings, our justification for including provisions specific to small refiners is that, in general, small refiners generally have a degree of hardship in complying with the standards compared to other refiners. In the NPRM, we proposed flexibilities/transition provisions, or "hardship provisions" (these terms are equivalent), for small refiners. We are adopting the provisions that were proposed for small refiners virtually unchanged, and including similar provisions for the treatment of locomotive and marine fuel.

a. Regulatory Process and Justification for Small Refiner Relief

In developing our NRLM diesel fuel sulfur program, we evaluated the environmental need as well as the technical and financial ability of refiners to meet the 500 and 15 ppm sulfur standards as expeditiously as possible. We believe it is feasible and necessary for the vast majority of the program to be implemented in the established time frame to achieve the air quality benefits as soon as possible. Based on information available from small refiners and others, we believe that refiners classified as small generally face unique circumstances with regard to compliance with environmental programs, compared to larger refiners. Consequently, as discussed below, we are finalizing several special provisions for refiners that qualify as "small refiners" to reduce the disproportionate burden that today's program will have on them.

Small refiners generally lack the resources that are available to large refining companies, including those large companies that own small-capacity refineries, to raise capital for investing in desulfurization equipment, such as shifting of internal funds, securing of financing, or selling of assets. Small refiners are also likely to have more difficulty in competing for engineering and construction resources needed for the installation of the desulfurization equipment which will likely be required to meet the standards finalized in this action.

Because small refiners are more likely to face adverse circumstances with regard to regulatory compliance than larger refiners, we are finalizing interim provisions that will provide additional time for refineries owned by small refiners to meet the sulfur standards. This approach will allow the overall program to begin as early as possible, avoiding the need for delay in order to address the ability of small refiners to comply.

i. Regulatory Flexibility Process for Small Refiners

As explained in the discussion of our compliance with the Regulatory Flexibility Act (RFA) in section X.C of this preamble, and in the Final Regulatory Flexibility Analysis in chapter 11 of the RIA, we considered the impacts of today's regulations on small businesses. Most of our analysis of small business impacts was performed as part of the Small Business Advocacy Review (SBAR) Panel convened by EPA, pursuant to the RFA as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA). The Panel's final report is available in the rulemaking public docket (Docket A-2001-28, Document No. II-A-172).

For the SBREFA process, EPA conducted outreach, fact-finding, and analysis of the potential impacts of the proposed nonroad regulations on small businesses. Based on these discussions and analyses by all panel members, the Panel concluded that small refiners in general would likely experience a significant and disproportionate financial burden in reaching the objectives of the proposed nonroad diesel fuel sulfur program.

One indication of the disproportionate burden on small refiners is the relatively high cost per gallon projected for producing NRLM diesel fuel under today's program. Refinery modeling

of refineries owned by refiners likely to qualify as small refiners, and of refineries owned by other non-small refiners, indicates significantly higher refining costs for small refiners. Specifically, we project that without special provisions, refining costs for small refiners on average would be about two cents per gallon higher than for other refiners in the same PADD to meet the 15 ppm sulfur standard.

The Panel also noted that the burden imposed on small refiners by the proposed sulfur standards may vary from refiner to refiner. Thus, the Panel recommended more than one type of burden mitigation so that most, if not all, small refiners could benefit. We considered the issues raised during the SBREFA process, and discussed them in the NPRM, and have decided to finalize each of the provisions recommended by the Panel. A discussion of the comments we received regarding small refiners and terminal operators, and our responses to those comments, can be found in section X.C of this preamble, and also the Summary and Analysis of Comments.

ii. Rationale for Small Refiner Regulatory Flexibility Provisions

Generally, we structured the small refiner provisions to reduce the burden on small refiners while expeditiously achieving air quality benefits and ensuring that the availability of 15 ppm sulfur NR diesel fuel will coincide with the introduction of 2011 model year nonroad diesel engines and equipment. We believe the special provisions for small refiners are necessary and appropriate for several reasons.

First, the compliance schedule for today's program, combined with special relief provisions for small refiners, will achieve the air quality benefits of the program as soon as possible, while helping to ensure that small refiners will have adequate time to raise capital for new or upgraded fuel desulfurization equipment. Most small refiners have limited additional sources of income beyond refinery earnings for financing and typically do not have the financial backing that larger and generally more integrated companies have. Therefore, additional time to accumulate capital internally or to secure capital financing from lenders can be central to their ability to comply.

Second, we recognize that while the sulfur levels in today's program can be achieved using conventional refining technologies, new technologies are also being developed that may reduce the capital and/or operating costs of sulfur removal. Thus, we believe that providing small refiners some additional time to allow for new technologies to be proven out by other refiners will have the added benefit of reducing the risks faced by small refiners. The added time will likely enable small refiners to benefit from the lower costs of these improvements in desulfurization technology (e.g., better catalyst technology or lower-pressure hydrotreater technology). This will help to offset the disproportionate financial burden that may be imposed upon small refiners.

Finally, providing small refiners more time to comply will spread out the availability of engineering and construction resources. Most refiners will need to install additional processing equipment to meet the NRLM diesel fuel sulfur requirements. We anticipate that there may be

significant competition for technology services, engineering resources, and construction management and labor. In addition, as has been the experience in gasoline sulfur control, vendors will be more likely to contract their services with the larger refiners first, as their projects will offer larger profits for the vendors. Temporarily delaying compliance for small refiners will spread out the demand for these resources and may help reduce cost premiums for everyone caused by limited engineering and construction supply.

We discuss below the provisions that we are finalizing to minimize the degree of hardship imposed upon small refiners by this program. With these provisions we are confident in going forward with the 500 ppm sulfur standard for NRLM diesel fuel in 2007 and the 15 ppm sulfur standard for NR diesel fuel in 2010 and for LM diesel fuel in 2012, for the rest of the industry. The provisions for small refiners will allow these refiners to continue to produce higher sulfur NRLM fuel until June 1, 2010, and similarly, will allow for the production of 500 ppm nonroad NRLM fuel until June 1, 2014. Without small refiner relief, we would have to consider delaying the overall program until the burden of the program on many small refiners was diminished, which would delay the air quality benefits of the overall program. By providing temporary relief to small refiners, we are able to adopt a program that expeditiously reduces NRLM diesel fuel sulfur levels in a feasible manner for the industry as a whole.

The four-year leadtime from which begins in 2010 for small refiners for locomotive and marine diesel fuel is identical to the relief that was supported by small refiners for nonroad diesel fuel. We believe that this relief is necessary and adequate to reduce the burden on small entities while still achieving our air quality goals. Small refineries vary considerably in their markets for NRLM diesel fuels. Consequently, the proposal to control nonroad diesel fuel to 15 ppm sulfur impacted small refiners with significant nonroad market shares, but left those with significant locomotive and marine market shares relatively untouched. With control of all NRLM diesel fuel to 15 ppm sulfur in this final rule, all small refiners of NRLM diesel fuel will face similar challenges, and therefore the same four year lead time from 2010 proposed for those small refiners impacted by nonroad fuel control alone is also appropriate when the standards are expanded to all NRLM. In essence, while more small refiners face the challenge of desulfurizing all of their diesel fuel to the 15 ppm sulfur standard, the magnitude of this challenge is not any greater. Furthermore, providing additional relief (beyond 2014) to small refiners would undermine the program by further delaying air quality benefits. The 2014 deadline for all small refiner diesel fuel to 15 ppm sulfur will also simplify the fuel program and it will allow small refiners the ability to coordinate their plans to reduce the sulfur content of all off-highway diesel fuel at the same time.

iii. Impact of Small Refiner Options on Program Emissions Benefits

Small refiners that choose to delay the NRLM diesel fuel sulfur requirements will also delay to some extent the emission reductions that would otherwise have been achieved. However, for several reasons, the overall impact of these postponed emission reductions will be small. First, small refiners represent only a fraction of national non-highway diesel production. Today,

refiners that we expect to qualify as small refiners represent only about six percent of all high-sulfur diesel production. Second, the delayed compliance provisions described below will affect only engines without new emission controls. During the program's first step to 500 ppm sulfur NRLM diesel fuel, small refiner NRLM diesel fuel could be well above 500 ppm sulfur, but the new advanced engine controls will not yet be required. During the second step to 15 ppm sulfur NRLM diesel fuel, equipment with the new controls will be entering the market, but use of the 500 ppm small refiner fuel will be restricted to older engines without the new controls. There will be some loss of sulfate PM control in the older engines that operate on higher sulfur small refiner fuel, but no effect on the major emission reductions that the new engine standards will achieve starting in 2011. Finally, because small diesel refiners are generally dispersed geographically across the country, the limited loss of sulfate PM control will also be dispersed.

One option for small refiner relief will allow a modest 20 percent relaxation in the gasoline sulfur interim standards for small refiners that produce all of their NRLM diesel fuel at 15 ppm sulfur by June 1, 2006. To the extent that small refiners elect this option, a small loss of emission control from Tier 2 gasoline vehicles that use the higher sulfur gasoline could occur. We believe that such a loss of control will be very small. Very few small refiners will be in a position to use this provision. Further, the relatively small production of gasoline with slightly higher sulfur levels should have no measurable impact on the emissions of new Tier 2 vehicles, even if the likely “blending down” of sulfur levels does not occur as this fuel mixed with lower sulfur fuel during distribution. This provision will also maintain the maximum 450 ppm gasoline sulfur per-gallon cap standard in all cases, providing a reasonable sulfur ceiling for any small refiners using this provision.

b. Small Refiner Definition for Purposes of the Hardship Provisions

The definition of small refiner under the NRLM diesel program is similar to the definitions under the Tier 2/Gasoline Sulfur and Highway Diesel rules. Under the NRLM program, a small refiner must demonstrate that it meets the following criteria:

- produced NRLM diesel from crude;
- no more than 1,500 employees corporate-wide, based on the average number of employees for all pay periods from January 1, 2002 to January 1, 2003; and,
- a corporate crude oil capacity less than or equal to 155,000 barrels per calendar day (bpcd) for 2002.

As with the earlier fuel sulfur programs, the effective dates for the determination of employee count and for calculation of the crude capacity represent the most recent complete year prior to the issuing of the proposed rulemaking (2002, in this case).

In determining its total number of employees and crude oil capacity, a refiner must include the number of employees and crude oil capacity of any subsidiary companies, any parent company and subsidiaries of the parent company, and any joint venture partners. We define a subsidiary of a company to mean any subsidiary in which the company has a 50 percent or greater ownership interest. However, refiners owned and controlled by an Alaska Regional or Village Corporation organized under the Alaska Native Claims Settlement Act (43 U.S.C. 1626), are also eligible for small refiner status, based only on the refiner's employees and crude oil capacity. Such an exclusion is consistent with our desire to grant regulatory relief to that part of the industry that is the most challenged with respect to regulatory compliance. We believe that very few refiners, probably only one, will qualify under this provision. We are also incorporating this exclusion into the small refiner provisions of the highway diesel and gasoline sulfur rules, which did not address this issue.

As under the gasoline sulfur and highway diesel fuel rules, refiners that either acquire or restart a refinery in the future may be eligible for small refiner status under the NRLM program. Specifically, a refiner that either acquires or restarts a refinery that was shut down or non-operational between January 1, 2002 and January 1, 2003 may apply for small refiner status. In such cases, we will judge eligibility under the employment and crude oil capacity criteria based on the most recent 12 consecutive months of data unless we conclude from the data provided by the refiner that another period of time is more appropriate. Companies with refineries built after January 1, 2002 are not eligible for the small refiner provisions. Similarly, entities that do not own or operate a refinery are not eligible to apply for small refiner status.

c. Provisions for Small Refiners

We are finalizing several provisions intended to reduce the regulatory burden of today's program on small refiners as well as to encourage their early compliance whenever possible. As described below, these small refiner relief options consist of additional time for compliance and, for small refiners that choose to comply earlier than required, the option of either generating diesel fuel sulfur credits or receiving a limited relaxation of their gasoline sulfur standards.

i. NRLM Delay Option

First, we are finalizing an option that allows small refiners to postpone their compliance with the NRLM diesel fuel sulfur standards. The delayed compliance schedule for small refiners is intended to compensate for the relatively higher compliance burdens on these refiners. It is not intended as an opportunity for those refiners to greatly expand their production of uncontrolled diesel fuel (2007-2010) or 500 ppm sulfur diesel fuel (2010-2014). To help ensure that any significant expansion of refining capacity that a small refiner might undertake in the future is accompanied by an expansion of desulfurization capacity, small refiners producing higher sulfur fuel must limit their production to baseline volume levels. Specifically, during the first step of today's diesel fuel program to 500 ppm sulfur, from June 1, 2007 through May 31, 2010, a small refiner may at any or all of its refineries produce uncontrolled NRLM diesel fuel up to the 2003

through 2005 non-highway baseline volume for the refinery(s). Any diesel fuel produced over the baseline volume will be subject to the 500 ppm sulfur standard applying to other refiners. Similarly, from June 1, 2010 through May 31, 2014, a small refiner may produce at any or all of its refineries NRLM diesel fuel subject to the 500 ppm sulfur standard at a volume equal to or less than the refineries' 2006-2008 non-highway baseline volumes. LM fuel produced to the 500 ppm standard during 2010 to 2012 would be counted towards meeting this baseline volume. NRLM fuel produced in excess of the baseline volume will be subject to the 15 ppm sulfur NRLM diesel fuel standard. The baseline for 2003-2005 will be determined by subtracting the refinery's highway volume from its total highway and heating oil volume production. The baseline for 2006-2008 will be determined based upon the volume of the refinery's NRLM fuel designations discussed in section IV.D.

As discussed in section IV.D, the costs to the distribution system to mark heating oil in areas of PADD 1 with high heating oil demand to distinguish it from small refiner or credit-using high sulfur NRLM made this option undesirable in these areas. Based on our review of anticipated small refiner situations, this portion of PADD 1 appears unlikely to provide a meaningful market for small refiners seeking this option. Therefore, in this part of the country it imposed costs without providing the intended benefit. Consequently, while this option was proposed to be available nationwide, we are not finalizing it for a portion of PADD 1. This change from the proposal should have no meaningful impact on small refiners' flexibility, but will reduce the costs for fuel distributors.

Since new engines with sulfur sensitive emission controls will begin to become widespread beginning in 2011, small refiner fuel can only be sold for use in pre-2011 nonroad equipment or in locomotives or marine engines during this time. Section IV.D below discusses the requirements for designating and tracking the production of 500 ppm sulfur NRLM diesel fuel produced by small refiners during this period.

The following table illustrates the small refiner NRLM diesel fuel sulfur standards as compared to the standards for the base NRLM diesel fuel program. As previously stated, small refiners will receive additional lead time, compared to non-small refiners for 15 ppm sulfur locomotive and marine diesel fuel. This lead time is identical to that which had been proposed for 15 ppm sulfur nonroad diesel fuel. This will ensure that emission benefits of ultra low sulfur diesel fuel are achieved as soon as possible, and should not significantly change the nature or magnitude of the burden on affected small refiners.

Table IV-4. – Small Refiner NRLM Diesel Fuel Sulfur Standards, ppm[a]

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015+
Non-Small Refiners- NR fuel	--	500	500	500	15	15	15	15	15	15
Non-Small Refiners- LM fuel	--	500	500	500	500	500	15	15	15	15
Small Refiners- NR diesel fuel	--	--	--	--	500	500	500	500	15	15
Small Refiners- LM diesel fuel	--	--	--	--	500	500	500	500	15	15

Notes:
[a] New standards will take effect on June 1 of the applicable year.

ii. NRLM Credit Option

Some small refiners have indicated that, for a variety of reasons, they might need to produce fuel meeting the NRLM diesel fuel sulfur standards earlier than required under the small refiner program described above. For some small refiners, the distribution system might limit the number of grades of diesel fuel that will be carried. Others might find it economically advantageous to make 500 ppm or 15 ppm sulfur NRLM diesel fuel earlier than required to prevent losing market share. At least one small refiner has indicated that it might decide to desulfurize its NRLM pool at the same time as it desulfurizes its highway diesel fuel, in June 2006, due to limitations in its distribution system and to take advantage of economies of scale.

The NRLM Credit option allows small refiners to participate in the NRLM diesel fuel sulfur credit banking and trading program discussed earlier in this section. Under this option, a small refiner may generate diesel fuel sulfur credits by producing any volume of 500 ppm sulfur NRLM diesel fuel from crude oil prior to from June 1, 2006 through May 31, 2010, and by producing any volume from crude oil of 15 ppm sulfur NRLM diesel fuel from June 1, 2010 through December 31, 2013. The specifics of the credit program are described in section IV.A.4, including how the program applies to small refiners. Generating and selling credits could provide small refiners with funds to help defray the costs of early NRLM compliance.

iii. NRLM/Gasoline Compliance Option

The NRLM/Gasoline Compliance option is available to small refiners that produce greater than 95 percent of their NRLM diesel fuel at the 15 ppm sulfur standard by June 1, 2006 and elect not to use the provision described above to earn NRLM diesel fuel sulfur credits for this early compliance.2 Refiners choosing this option will receive a modest revision in their small refiner interim gasoline sulfur standards, beginning January 1, 2004. Specifically, the applicable small refiner annual average and per-gallon cap gasoline sulfur standards will be increased by 20 percent for the duration of the interim program. The interim program is through either 2007 or

2010, depending on whether the refiner extended the duration of its interim gasoline sulfur standards by producing 15 ppm sulfur highway diesel fuel by June 1, 2006, as provided under 40 CFR 80.552(c). In no case may the per-gallon gasoline sulfur cap exceed 450 ppm, the highest level allowed under the gasoline sulfur program.

We believe it is very important to link any relaxation of a small refiner's interim gasoline sulfur standards with the environmental benefit of early desulfurization of a significant volume of NRLM diesel fuel. As such, a small refiner choosing to use this option must produce a minimum volume of NRLM diesel fuel at the 15 ppm sulfur standard by June 1, 2006. Each participating small refiner must produce a volume of 15 ppm sulfur fuel that is at least 85 percent of the annual average volume of non-highway diesel fuel it produced from 2003-2005. If the refiner began to produce gasoline in 2004 at the higher interim standard under this provision but then either fails to meet the 15 ppm sulfur standard for its NRLM diesel fuel by June 1, 2006 or fails to meet the 85 percent minimum volume requirement, the original small refiner interim gasoline sulfur standard applicable to that refiner will automatically apply retroactively to 2004. In addition, the refiner must compensate for the higher gasoline sulfur levels by purchasing gasoline sulfur credits or producing an equivalent volume of gasoline below the required sulfur levels. Under this option, a small refiner could in effect shift some funds from its gasoline sulfur program to accelerate desulfurization of NRLM diesel fuel. While there would be a small potential loss of emission reduction under the gasoline sulfur program from fuel produced by the very few small refiners that we believe would choose this second option, there are also environmental benefits gained from the production of 15 ppm sulfur diesel fuel earlier than otherwise required.

iv. Relationship of the Options to Each Other

A small refiner may choose to use the NRLM Delay option, the NRLM Credit option or both in combination, since it has no requirement to produce 500 ppm sulfur NRLM diesel fuel before June 1, 2010, or 15 ppm sulfur NRLM diesel fuel before June 1, 2014. Thus any fuel that it produces from crude at or below the sulfur standards earlier than required will qualify for generating credits.

On the other hand, the NRLM/Gasoline Compliance option may not be used in combination with either the NRLM Delay option or the NRLM Credit option, since a small refiner must produce at least 85 percent of its NRLM diesel fuel at the 15 ppm sulfur standard under the NRLM/Gasoline Compliance option.

d. How Do Refiners Apply for Small Refiner Status?

A refiner applying for small refiner status must provide the Agency with several types of information by December 31, 2004. The detailed application requirements are summarized in section V.F.2 below. In general, a potential small refiner must own the refinery/refineries in question and must provide the following information for the parent company and all subsidiaries at all locations: 1) the average number of employees for all pay periods from January 1, 2002

through January 1, 2003; 2) the total corporate crude oil capacity, which must be a positive number; and 3) an indication of which small refiner option the refiner intends to use (see section IV.B.1.c above). As with applications for relief under other fuel programs, applications for small refiner status under this rule that are later found to contain false or inaccurate information will be void *ab initio*.

e. The Effect of Financial and Other Transactions on Small Refiner Status and Small Refiner Relief Provisions

Since the gasoline sulfur and highway diesel fuel sulfur programs were finalized, several refiners have raised concerns about how various financial and other transactions could affect implementation of the small refiner fuel sulfur provisions. These types of transactions typically involve refiners with approved small refiner status that are involved in potential or actual sales of the small refiner's refinery, or involve the small refiner merging with another refiner or purchasing another refinery (or other non-refining asset). We believe that these concerns are also relevant to the small refiner provisions described below for the NRLM diesel fuel sulfur program.

i. Large Refiner Purchasing a Small Refiner's Refinery

The first type of transaction involves a "non-small" refiner that wishes to purchase a refinery owned by an approved small refiner. In some cases, the small refiner may not have completed or even begun refinery upgrades to meet the long-term fuel sulfur standards if it was using an interim small refiner compliance provision. Under the gasoline sulfur and highway diesel fuel sulfur programs, once such a purchase transaction is completed, the "non-small" buyer does not have the benefit of the small refiner relief provisions that had applied to the previous owner.

The purchasing refiner would have to perform the necessary upgrades on the acquired refinery for it to meet the "non-small" sulfur standards. As the gasoline sulfur and highway diesel fuel sulfur provisions existed prior to today's action, such a refiner would be left with very little or, in the case of the gasoline sulfur program which has already begun, no lead time to bring the refinery into compliance. The refiners that have raised this issue have claimed that refiners in this situation would not be able to immediately comply with the "non-small refiner" standards upon acquisition of the new refinery. These refiners claim that this could prevent them from purchasing a refinery from a small refiner and, as a result, this would severely limit the ability of small refiners to sell such an asset. The refiners that raised this issue requested additional lead time before the non-small refiner sulfur standards take effect.

We received comments on this issue from two refiners. Both refiners commented that lead time for refiners losing their small refiner status should only be allowed for the case where a small refiner merges with, or acquires, another small refiner. Neither refiner supports allowing additional lead time for a large refiner that merges with or acquires a small refiner. In addition, these refiners also commented that it would be inappropriate to allow a small refiner that receives

this lead time to be able to generate credits for “early” production of lower sulfur diesels during this two-year period.

Nevertheless, we continue to believe these lead-time concerns are valid. Failure to address them could lead to unnecessary disruption to the diesel fuel market. Therefore, we are adopting a provision to provide an appropriate period of lead time for compliance with the NRLM diesel fuel sulfur requirements for situations in which a refiner purchases any refinery owned by a small refiner, whether by purchase of the refinery or purchase of the small refiner entity. Refiners that acquire a refinery from an approved small refiner will be provided 30 additional months from the date of the completion of the purchase transaction (but no later than June 1, 2010 for 500 ppm NRLM fuel and June 1, 2014 for 15 ppm NRLM fuel). During this interim period, production at the newly-acquired refinery may remain at the interim sulfur levels that applied to that refinery for the previous small refiner owner under the small refiner options discussed below. At the end of this period, the refiner must comply with the “non-small refinery” sulfur standards.

We received comments suggesting that the proposed 24 months of additional lead time would not be adequate, and further, discussions with several refiners indicated that in most cases, 24 months would be inadequate. As discussed in section IV.F, we project a range of 27-39 months is needed to design and construct a diesel hydrotreater. Therefore, in order to allow a reasonable opportunity for complying, we are finalizing the provision that 30 months of additional lead time will be afforded. Thirty months should in most cases be sufficient for the new refiner-owner to accomplish the necessary engineering, permitting, construction, and start- up of the necessary desulfurization equipment. However, if there are instances where the technical characteristics of its planned desulfurization project will require additional lead time, we have included provisions for the refiner to apply for up to six months of additional time and for EPA to consider such requests on a case-by-case basis. Such an application must be based on the technical factors supporting the need for more time and should include detailed technical information and projected schedules for engineering, permitting, construction, and startup. Based on information provided in such an application and other relevant information, EPA will decide whether additional time is technically necessary and, if so, how much additional time is appropriate. However, we anticipate that in most cases 30 months will be sufficient, since developing plans for compliance should be expected to be a part of any purchase decision.

All existing small refiner provisions and restrictions, as described below, will also remain in place for that refinery during the 30 months of additional lead time and any further lead time approved by EPA for the purchasing refiner; including the per-refinery volume limitation on the amount of NRLM diesel that may be produced at the small refiner standards. Furthermore, since the purpose of this grace period is solely to provide time to bring the refinery into compliance with the NRLM standards, refiners will not be allowed to generate credits for early compliance during this 30 month period. There will be no adverse environmental impact of this provision, since the small refiner would have already been provided this same relief prior to the purchase and this provision is no more generous.

ii. Small Refiner Losing Its Small Refiner Status due to Merger or Acquisition

Another type of transaction involves a refiner with approved small refiner status that later loses its small refiner status because it exceeds the small refiner criteria. Under the gasoline sulfur and highway diesel fuel sulfur regulations, an approved small refiner that exceeds 1,500 employees due to merger or acquisition will lose its small refiner status. We also intended for refiners that exceeded the 155,000 barrel per calendar day crude capacity limit due to merger or acquisition to lose its small refiner status and in this rule we are amending the regulations to reflect that criterion as well. This includes exceedances of the employee or crude capacity criteria caused by acquisitions of assets such as plant and equipment, as well as acquisitions of business entities.

Our intent in the gasoline and highway diesel fuel sulfur programs, as well as the NRLM diesel fuel sulfur program, has been and continues to be, limiting the small refiner relief provisions to a small subset of refiners that are challenged, as discussed above. At the same time, it is also our intent to avoid stifling normal business growth. Therefore, the regulations we are adopting today will disqualify a refiner from small refiner status if it exceeds the small refiner criteria through its involvement in transactions such as being acquired by or merging with another entity, through the small refiner itself purchasing another entity or assets from another entity, or when it ceases to process crude oil. However, an approved small refiner who exceeds the employee or crude oil capacity criteria without merger or acquisition, may retain its small refiner status for the purposes of the complying with the NRLM diesel fuel standards. Furthermore, in the sole case of a merger between two approved small refiners we will allow such refiners to retain their small refiner status for purposes of complying with the NRLM diesel fuel program. Commenters explained that additional financial resources would not typically be provided in the case of a merger between small refiners. In light of these comments, we believe the justification for continued small refiner relief for the merged entity is valid. Small refiner status for the two entities of the merger will not be affected, hence the original compliance plans of the two refiners should not be impacted. Moreover, no environmental detriment will result from the two small refiners maintaining their small refiner status within the merged entity as they would have likely maintained their small refiner status had the merger not occurred.

Consistent with our intent in the gasoline sulfur and highway diesel fuel sulfur programs to limit the use of the small refiner hardship provisions, we also intended in the gasoline sulfur and highway diesel fuel sulfur programs that an exceedance of corporate crude oil capacity limit of 155,000 bpcd, due to merger or acquisition, would be grounds for disqualifying a refiner's small refiner status. However, we inadvertently failed to include this second criterion as grounds for disqualification in the regulations. In today's action, we are resolving this error by including the crude capacity limit, along with the employee limit for both the gasoline sulfur and highway diesel fuel sulfur programs, effective January 1, 2004. Thus, a refiner exceeding either criterion due to merger or acquisition will lose its small refiner status. The exception to this would be in the case of merger only between two small refiners. We received comments supporting the allowance of

additional lead time for small refiners that lose their small refiner status through a merger with, or acquisition of, another small refiner.

We recognize that a small refiner that loses its small refiner status because of a merger with, or acquisition of, a non-small refiner would face the same type of lead time concerns in complying with the non-small refiner standards as a non-small refiner that acquired a small refiner's refinery would. Therefore, the additional lead time described above for non-small refiners purchasing a small refiner's refinery will also apply to this situation. Thus, this 30 month lead time will apply to all of the refineries, existing or newly-purchased, that had previously been subject to the small refiner program, but would not apply to a newly-purchased refinery that is subject to the non-small refiner standards. Again, there would be no adverse environmental impact because of the pre-existing relief provisions that applied to the newly- purchased small refiner.

The issues discussed in this section apply equally to the gasoline sulfur and highway diesel fuel sulfur programs. Thus, we are also adopting the same provisions relating to additional lead time in cases of certain financial, or other, transactions for the small refiner programs in the earlier fuel sulfur programs.

In the proposal for today's final rule, we invited comment on several other related provisions that were considered during the development of this rulemaking:

(1) Instead of merely allowing small refiners a grace period to come into compliance if they lose their small refiner status, we also asked for comment on whether or not such a small refiner should instead be allowed to "grandfather" the small refiner relief provisions for its existing refinery or refineries. We did not receive any specific comments on this issue and we are not finalizing this provision in today's action.

(2) Regarding small refiners that exceed the small refiner criteria due to the purchase of a non-small refiner's refinery, we requested comment on whether or not the proposed additional lead time should apply to the purchased refinery. We also requested comment on whether or not the refiner should be required to meet the non-small refiner standards on schedule at the purchased refinery, since the previous owner could be assumed to have anticipated the new standards and taken steps to accomplish this prior to the purchase. One refiner commented that merger acquisition flexibility for refineries that lose their small refiner status should be limited to instances where a small refiner merges with another small refiner. They believed that any small refiner that loses its small refiner status due to an acquisition of a non-small refiner's refinery should not be eligible for hardship relief. Similarly, another refiner commented that a refiner should not retain small refiner status if it has the financial resources to acquire additional refineries that increase corporate-wide crude processing above 155,000 bpd. We are not adopting any flexibility for the purchased refinery in this situation (except in the case of a merger between two small refiners, as discussed above).

f. Provisions for Approved Gasoline and Highway Diesel Fuel Small Refiners that do not Qualify for Small Refiner Status Under Today's Program

Some refiners that have approved small refiner status under the gasoline sulfur and highway diesel fuel programs may not qualify for small refiner status under today's program if they have grown through normal business operations and now exceed the qualification criteria for NRLM small refiner status. One refiner commented on the lack of a “grandfather” provision in the nonroad proposal that would automatically continue small refiner status to refiners already approved as small refiners under the gasoline and highway diesel fuel sulfur programs. Without such a provision some refiners could be approved small refiners under the gasoline sulfur and highway diesel fuel sulfur programs (because they grew through normal business expansions and not through merger or acquisition) but would not qualify under the NRLM program because they now exceed the criteria. As a consequence, the commenter argued that in some cases benefits afforded to such small refiners under the gasoline and highway diesel fuel sulfur programs could be negated. Specifically, under the highway diesel rule they were allowed until 2010 before needing to have diesel fuel hydrotreating capacity. Under the nonroad rule, they would have to do so in 2007. Since it would only make sense to invest for adequate 15 ppm capacity when they do invest, the nonroad standards essentially would require them to invest to bring all highway and nonroad diesel to 15 ppm sulfur in 2007, eliminating the flexibility granted them in the highway rule. Furthermore, the refiners' clean fuel projects for low sulfur gasoline, highway diesel fuel, and NRLM diesel fuel could no longer be staggered. In fact, small refiners in such situations would be required to make investments for compliance with all three fuel programs in the same three to four year period, if not virtually all at once.

We believe that a refiner who no longer meets the criteria for small refiner status, since it has successfully grown through normal business operations, does not face the same level of hardship described earlier in this section. We do not intend for the NRLM program to undermine the benefits afforded to small refiners under the gasoline and highway diesel fuel sulfur programs, as described in the comments. At the same time, however, we want to preserve small refiner status under today's program only for those businesses that meet the criteria described above. Under the nonroad proposal, a refiner with approved small refiner status under the highway diesel fuel program but not the NRLM program would be required to produce 500 ppm sulfur NRLM diesel fuel in 2007 and both 15 ppm sulfur highway and NR diesel fuel in 2010. Under today's final program, such a refiner may instead skip the 2007 500 ppm interim sulfur standard for its NRLM diesel fuel, and meet the 15 ppm sulfur standard for both its highway and NR diesel fuel in 2010 and LM diesel fuel in 2012. Such an approach will maintain the refiner’s flexibility under the highway program by allowing it to delay diesel hydrotreating investment until 2010, while limiting its flexibility under the nonroad diesel program.

g. Additional Provisions and Program Elements

To reduce the burden on all refiners (including small refiners), we have chosen to finalize the designate and track approach, rather than the baseline approach. Discussions with parties in

all parts of the distribution system led us to believe that this is the preferred approach, as tracking is currently done by parties throughout the distribution system. We are also finalizing provisions to simplify the segregation, marking, and dyeing requirements. In addition, we are finalizing provisions to alleviate the concern raised by small terminal operators regarding the heating oil marker. Terminals in parts of PADD 1 (Northeast/Mid-Atlantic Area) will not have to add the marker to home heating oil. Therefore we expect that no terminals inside of the Northeast/Mid-Atlantic Area will need to install injection equipment. These provisions are discussed in greater detail in section IV.D, below.

2. General Hardship Provisions

a. Temporary Waivers from NRLM Diesel Fuel Sulfur Requirements in Extreme Unforseen Circumstances

We are finalizing a provision which, at our discretion, will permit any domestic or foreign refiner to seek a temporary relief from the NRLM diesel fuel sulfur standards under certain rare circumstances. This waiver provision is similar to provisions in the reformulated gasoline, low sulfur gasoline, and highway diesel fuel sulfur regulations. It is intended to provide refiners short-term relief due to unanticipated circumstances, such as a refinery fire or a natural disaster, that cannot be reasonably foreseen now or in the near future.

Under this provision, a refiner may seek a waiver to distribute NRLM diesel fuel that does not meet the applicable 500 ppm or 15 ppm sulfur standards for a brief time period. An approved waiver of this type could, for example, allow a refiner to produce and distribute diesel fuel with higher than allowed sulfur levels, so long as the other conditions described below were met. Such a request must be based on the refiner's inability to produce complying NRLM diesel fuel because of extreme and unusual circumstances outside the refiner's control that could not have been avoided through the exercise of due diligence. The request must also show that other avenues for mitigating the problem, such as the purchase of credits to be used toward compliance, had been pursued yet were insufficient. As with other types of regulatory relief established in this rule, this type of temporary waiver will have to be designed to prevent fuel exceeding the 15 ppm sulfur standard from being used in 2011 and later model year nonroad engines.

The conditions for obtaining a NRLM diesel fuel sulfur waiver are similar to those under the RFG, gasoline sulfur, and highway diesel fuel sulfur regulations. These conditions are necessary and appropriate to ensure that any waivers that are granted are limited in scope, and that refiners do not gain economic benefits from a waiver. Therefore, refiners seeking a waiver will be required to show that the waiver is in the best public interest and that they: 1) were not able to avoid the nonconformity; 2) will make up the air quality detriment associated with the waiver; 3) will make up any economic benefit from the waiver; and 4) will meet the applicable diesel fuel sulfur standards as expeditiously as possible.

b. Temporary Relief Based on Extreme Hardship Circumstances

In addition to the provision for short-term relief under extreme unforseen circumstances, we are finalizing a provision for relief based on extreme hardship circumstances such as circumstances that impose extreme hardship and significantly affect a refiners ability to comply with the program requirements by the applicable dates. This provision is also very similar to those established under the gasoline sulfur and highway diesel fuel sulfur programs. Under the gasoline sulfur program, we have granted relief in the form of individual compliance plans to five refiners. Under the highway diesel program, we have approved two. Each plan was designed for the specific situation of that refiner. In all cases, the companies would have experienced severe hardship if temporary relief had not been granted. Moreover, some refineries were at a high risk of shutting down without the relief.

In developing today's program, as under our other fuel programs, we considered whether any refiners would face particular difficulty in complying with the standards in the lead time provided. As described earlier in this section, we concluded that, in general, small refiners would experience more difficulty in complying with the standards on time because they have less ability to raise the capital necessary for refinery investments, face proportionately higher costs because of poorer economies of scale, and are less able to successfully compete for limited engineering and construction resources. However, it is possible that other refiners that are not small refiners may also face particular difficulty in complying on time with the sulfur standards required under today's program. Therefore, we are including in this rulemaking a provision which allows us, at our discretion, to grant temporary waivers from the NRLM diesel fuel sulfur standards based on a showing of extreme hardship circumstances.

The extreme hardship provision allows any domestic or foreign refiner to request relief from the sulfur standards based on a showing of unusual circumstances that result in extreme hardship and significantly affect a refiner’s ability to comply with either the 500 ppm or 15 ppm sulfur NRLM diesel fuel standards by either June 1, 2007, June 1, 2010, or June 1, 2012, respectively. The Agency will evaluate each application on a case-by-case basis, considering the factors described below. Approved hardship applications may include compliance plans with relief similar to the provisions for small refiners, which are described in detail above in section IV.B.1.c. Depending on the refiner's specific situation, such approved delays in meeting the sulfur requirements may be more stringent than those allowed for small refiners, but will not likely be less stringent. Given such an approval, we expect to impose appropriate conditions to: 1) assure the refiner is making its best effort; and 2) minimize any loss of emissions benefits from the program. As with other relief provisions established in this rule, any waiver under this provision will be designed to prevent fuel exceeding the 15 ppm sulfur standard from being used in 2011 and later model year nonroad engines.

Providing short-term relief to those refiners that need additional time because they face hardship circumstances facilitates adoption of an overall program that reduces NRLM diesel fuel sulfur to 500 ppm beginning in 2007, and NRLM diesel fuel sulfur to 15 ppm in 2010 and 2012,

for the majority of the industry. However, we do not intend for this waiver provision to encourage refiners to delay the planning and investments they would otherwise make. We do not expect to grant temporary waivers that apply to more than approximately one percent of the national NRLM diesel fuel pool in any given year.

The regulatory language for today's action includes a list of the information that must be included in a refiner's application for an extreme hardship waiver. If a refiner fails to provide all of the information specified in the regulations as part of its hardship application, we will deem the application void. In addition, we may request additional information as needed. Our experience to date shows that detailed technical and financial information from the companies seeking relief has been necessary to fully evaluate whether a hardship situation exists. The following are some examples of the types of information that must be contained in an application:

- The crude oil refining capacity and fuel sulfur level(s) of each diesel fuel product produced at each of the refiner's refineries.

- A technical plan for capital equipment and operating changes to achieve the NRLM diesel fuel sulfur standards.

- The anticipated timing for the overall project the refiner is proposing and key milestones to ultimately produce 100 percent of NRLM diesel fuel at the 15 ppm sulfur cap.

- The refiner's capital requirements for each step of its proposed projects.

- Detailed plans for financing the project and financial statements demonstrating the nature of and degree of financial hardship and how the requested relief would mitigate this hardship. This would include a description of the overall financial situation of the company and its plans to secure financing for the desulfurization project (e.g., internal cash flow, bank loans, issuing of bonds, sale of assets, or sale of stock).

- A plan demonstrating how the refiner would achieve the standards as quickly as possible, including a timetable for obtaining the necessary capital, contracting for engineering and construction resources, obtaining any necessary permits, and beginning and completing construction.

- A description of the market area for the refiner's diesel fuel products.

- In some cases, it could also include a compliance plan for how the refiner's diesel fuel will be segregated through to the end-user and information on each of the end-users to whom its fuel is delivered.

We will consider several factors in our evaluation of any hardship waiver applications that we receive. Such factors include whether a refinery's configuration is unique or atypical; the

proportion of non-highway diesel fuel production relative to other refinery products; whether the refiner, its parent company, and its subsidiaries are faced with severe economic limitations and steps the refiner has taken to attempt to comply with the standards, including efforts to obtain credits towards compliance. In addition, we will consider the total crude oil capacity of the refinery and its parent or subsidiary corporations, if any, in assessing the degree of hardship and the refiner's role in the diesel market. Finally, we will consider where the diesel fuel is intended to be sold in evaluating the environmental impacts of granting a waiver. Typically, because of EPA's comprehensive evaluation of both financial and technical information, action on hardship applications can take six or more months.

This extreme hardship provision is intended to address unusual circumstances that should be apparent now or could emerge in the near future. Thus, refiners seeking additional time under this provision must apply for relief by June 1, 2005, although we retain the discretion to consider hardship applications later as well for good cause.

3. Provisions for Transmix Facilities

In the petroleum products distribution system, certain types of interface mixtures in product pipelines cannot be added in any significant quantity to either of the adjoining products that produced the interface. These mixtures are known as "transmix." The pipeline and terminal industry's practice is to transport transmix via truck, pipeline, or barge to a facility with an on-site fractionator that is designed to separate the products. The owner or operator of such a facility is called a "transmix processor." Such entities are generally considered to be a refiner under existing EPA fuel regulations.

Transmix processors, like conventional refiners, are also currently subject to the "80 percent / 20 percent" production requirement for 15 ppm and 500 ppm sulfur highway diesel fuel. This requirement, however, is inconsistent with the inherent nature of the transmix processors' business. Unlike conventional refiners, transmix processors refine batches of fuel that vary in volume and timing – largely unpredictably. Complying with set percentages of different highway diesel fuel sulfur grades would be very difficult, probably resulting in either a need to purchase credits or to postpone processing of some shipments. Transmix processors commented that it would not be appropriate to have any additional restrictions, beyond those based on sulfur content, imposed on their ability to market the fuel that they produce. They stated that the implementation of other restrictions, such as those under the highway diesel program's 80/20 requirement, would force them to ship large volumes of blendstocks back to refineries by truck, resulting in tank lock-outs that could cascade upstream though the distribution system potentially interfering with pipeline operations.[103]

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[103] In a tank lock out situation a storage tank can no longer accept product from upstream in the distribution system because there is not sufficient outlet for the product it holds. A tank lock our downstream can quickly propagate upstream.

Furthermore, transmix processors do not have the ability to change the nature of their products, as their processing equipment consists only of a distillation column to separate the blendstocks. This simple refinery configuration further limits their ability to install and operate a distillate hydrotreater. The commenters added that the sulfur content of the slate of fuel products that they produce is completely dependant on feed material that they receive, and that it is not feasible for them to install desulfurization equipment. We agree that it is not feasible for transmix processors to alter the sulfur content of the fuels that they produce and that limiting the market for these fuels could potentially lead to disruptions in the fuel distribution system.

In light of this disproportionate burden on transmix processors, today's final rule removes the restriction on the volume of highway or NRLM diesel fuel they produce, if they produce diesel fuel according to typical operational practices involving the separation of transmix and not, for example, by blending of blendstocks or processing crude or heavy oils. Therefore, under today's final rule, transmix processors may choose to continue to produce all of their highway diesel fuel to the 500 ppm sulfur standard until 2010. They may further choose to continue to produce all of their NRLM diesel fuel as high sulfur diesel fuel until June 1, 2010, all of their NRLM diesel fuel to the 500 ppm sulfur standard until June 1, 2014, and all of their LM diesel fuel to a 500 ppm sulfur limit indefinitely.

Transmix processors will be required to properly designate their fuel with the proper PTDs. Because the volume of fuel involved will be small and the fuel processed will already have been off-specification, we believe that providing this flexibility for transmix processors will have essentially no environmental impact and will not affect the efficient functioning of the NRLM diesel fuel program or the existing highway diesel fuel program. Rather, this approach will allow fuel volume to remain in the highway, NRLM, or LM (as applicable based on time frame) markets that might otherwise be forced into the heating oil market.

C. Special Provisions for Alaska and the Territories

1. Alaska

The nationwide engine emission standards established today apply to all NR engines throughout Alaska. The nationwide NRLM diesel fuel sulfur standards and implementation dates apply to NRLM diesel fuel used in the areas of Alaska served by the federal aid highway system (FAHS). In this final rule, EPA is not finalizing fuel sulfur standards and implementation deadlines for NRLM diesel fuel used in the areas of Alaska not served by the FAHS (i.e., the “rural” areas). They will be addressed in a separate rulemaking to allow EPA to address the requirements for highway and NRLM diesel fuel in the rural areas in the same rulemaking. This final rule does, however, adopt the prohibition in the rural areas on the use of high sulfur (greater than 15 ppm) diesel fuel in model year 2011 and later nonroad engines, which will be manufactured to operate on ultra-low sulfur diesel fuel.

a. How do the Highway Diesel Engine Standards, the Highway Diesel Fuel Standards, and Implementation Deadlines Apply in Alaska?

Unlike the rest of the nation, Alaska is currently exempt from the 500 ppm sulfur standard for highway diesel fuel and the dye provisions for diesel fuel not subject to this standard. Since the beginning of the 500 ppm sulfur highway diesel fuel program, we have granted Alaska exemptions from both the sulfur standard and dye provisions because of its unique geographical, meteorological, air quality, and economic factors.[104] On December 12, 1995, Alaska submitted a petition for a permanent exemption for all areas of the state served by the FAHS, that is, those areas previously covered only by a temporary exemption. While considering that petition, we started work on a nationwide rule to consider more stringent highway diesel fuel requirements for sulfur content.

In the January 18, 2001, highway diesel rule EPA fully applied the 2007 motor vehicle engine emission standards in Alaska. Based on factors unique to Alaska, we provided the state with: (1) an extension of the exemption from the 500 ppm sulfur fuel standard until the effective date of the new 15 ppm sulfur standard for highway diesel fuel in 2006; (2) an opportunity to request an alternative implementation plan for the 15 ppm sulfur diesel fuel program; and (3) a permanent exemption from the diesel fuel dye provisions. In response to these provisions in our January 18, 2001, highway rule, Alaska informed us that areas served by the FAHS, *i.e.*, communities on the connected road system or served by the Alaska state ferry system ("urban" areas), would follow the nationwide requirements.[105] Diesel fuel produced for use in areas of Alaska served by the FAHS will therefore be required to meet the same requirements for highway diesel fuel as diesel fuel produced for the rest of the nation. For the rural parts of the state – areas not served by the FAHS – Alaska requested that highway diesel fuel not be subject to the highway diesel fuel sulfur standard until June 1, 2010. Between 2006 and 2010, the rural communities would choose their own fuel management strategy, except that all 2007 model year and newer diesel vehicles would require ultra-low sulfur diesel fuel. Beginning June 1, 2010, all highway diesel fuel in the rural areas would be subject to the 15 ppm sulfur highway diesel fuel sulfur standard.[106] EPA intends to propose and request comment on an amendment to the highway diesel sulfur rule to incorporate the rural area transition plan submitted by the state.

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[104] Copies of information regarding Alaska's petition for exemption, subsequent requests by Alaska, public comments received, and actions by EPA are available in public docket A–96–26.

[105] Letter and attached document to Jeffrey Holmstead of EPA from Michele Brown of the Alaska Department of Environmental Conservation, dated April 1, 2002. The communities on the connected road system or served by the Alaska State ferry system are listed in the attached document.

[106] Letter and attached document to Jeffrey Holmstead of EPA from Ernesta Ballard of the Alaska Department of Environmental Conservation, dated June 12, 2003.

b. What NRLM Diesel Fuel Standards Are We Establishing for Urban Areas of Alaska?

Since Alaska is currently exempt from the 500 ppm sulfur standard for highway diesel fuel, we also considered exempting Alaska from the 500 ppm sulfur step of the proposed NRLM standards. However, despite the exemption, officials from the state of Alaska have informed us that some 500 ppm sulfur diesel fuel is nevertheless being marketed in many parts of Alaska. Market forces have brought the prices for 500 ppm diesel fuel down such that it is now becoming competitive with higher sulfur, uncontrolled diesel fuel. Assuming this trend continues, requiring that NRLM diesel fuel be produced to 500 ppm beginning June 1, 2007 would not appear to be unduly burdensome. Even if 500 ppm diesel fuel were not available in Alaska today, our expectation is that compliance with the highway program described above will likely result in the transition of all of the urban area highway diesel fuel distribution system to 15 ppm sulfur beginning in 2006. It could prove very challenging for the distribution system in some of the areas to segregate a 500 ppm sulfur grade of NRLM from a 15 ppm sulfur grade of highway and an uncontrolled grade for other purposes. We believe economics would determine whether the distribution system would handle the new grade of fuel or substitute 15 ppm sulfur highway diesel fuel for NRLM applications. Thus, in the 2007 to 2010 time frame, the NRLM market in some urban areas might be supplied with 500 ppm sulfur diesel, and in other areas might be supplied with 15 ppm sulfur diesel. For this reason, today's action applies the 500 ppm sulfur standard for NRLM diesel fuel to Alaska's urban areas.

Regardless of what occurs prior to 2010, we anticipate that 15 ppm sulfur highway diesel fuel will be made available in urban areas of Alaska by this time frame. The 2007 and later model year highway fleet will be growing, demanding more and more supply of 15 ppm sulfur diesel fuel. Adding nonroad volume to this would not appear to create any undue burden. Thus, today's action also applies the 15 ppm sulfur standard for NR and LM diesel fuel in the urban areas of Alaska, along with the rest of the nation beginning June 1, 2010 and June 1, 2012, respectively.

The state, in its comments on the proposal, supports today's action for the urban areas described above. One refiner in Alaska commented that we should implement a one-step approach requiring 15 ppm sulfur diesel fuel starting in 2010. The refiner indicated that, due to the limited NRLM market, the benefits of introducing 500 ppm sulfur diesel fuel in 2007 would be minimal. Also, the distribution system in Alaska is not capable of handling the two grades of diesel fuel that would be required between 2007 and 2010, thus 15 ppm sulfur fuel would be distributed as NRLM. We agree that the distribution system in Alaska is limited compared to the rest of the nation, and that consumption of diesel fuel by NRLM applications in Alaska is small. However, as previously discussed, we expect that some 500 ppm sulfur diesel fuel will be available due to market forces, and that 15 ppm sulfur highway diesel fuel will be available beginning in 2006 in the urban areas. Thus, requiring 500 ppm sulfur diesel fuel (or 15 ppm sulfur diesel fuel as a substitute) for the limited NRLM applications beginning in 2007 does not appear to create any undue burden on the fuel supply or the distribution system in urban Alaska.

During the development of the original 500 ppm sulfur highway diesel fuel standards in the early 1990's, refiners and distributors in Alaska expressed concern that if Alaska were required to dye its non-highway diesel fuel red along with the rest of the country, residual dye in tanks or other equipment would be enough to contaminate and disqualify Jet-A kerosene used as aviation fuel. Since much of the diesel fuel in Alaska is No. 1 and is indistinguishable from Jet-A kerosene, not only would tanks and transfer equipment have to be cleaned, but separate tankage would be needed. Consequently, we granted Alaska temporary exemptions from the dye requirement and in the January 18, 2001, highway diesel rule granted the state a permanent exemption.

The proposed use of a marker for heating oil in the 2007–10 time period presents similar concerns in Alaska's distribution system. In response to our request for comments on this issue, the state and refiners indicated that Alaska's system is not capable of accommodating dyes or markers and segregation. The priority of the state and fuel industry is to keep dyes and markers out of the fuel stream to prevent contamination of Jet-A and facilitate movement of the fuel. The comments suggested that implementation of refiner product designations, labeling of fuel pumps, retailer education, and rapid transition to ULSD would ensure that 500 ppm sulfur diesel fuel is used in NRLM equipment from 2007–10 and that 15 ppm sulfur diesel fuel is used in nonroad equipment after 2010.

In section IV.D below, we discuss the provisions that we are adopting for the State of Alaska that will allow us to enforce the NRLM diesel fuel program without requiring the fuel marker.

c. Why Are We Deferring Final Action on NRLM Diesel Fuel Standards for Rural Areas of Alaska?

We are deferring final action on the fuel sulfur standards and implementation deadlines for the rural areas of Alaska. We proposed to permanently exempt NRLM diesel fuel used in the rural areas from fuel content standards, except that diesel fuel used in 2011 and later model year nonroad engines would have had to meet the sulfur content standard of 15 ppm sulfur. However, this proposed action is inconsistent with the action requested by the state in its comments to the proposal. It is also inconsistent with the state's alternative implementation plan for highway diesel fuel in rural Alaska, which was submitted after publication of the proposal.

We intend to issue a supplemental proposal that would address both highway and NRLM diesel fuel sulfur standards for Alaska's rural areas. This proposal will address the comments submitted by the state, as well as the state's alternative implementation plan for highway diesel fuel.

2. American Samoa, Guam, the Commonwealth of Northern Mariana Islands, and Puerto Rico

a. What Provisions Apply in American Samoa, Guam, and the Commonwealth of Northern Mariana Islands?

As we proposed, we are excluding American Samoa, Guam and the Commonwealth of the Northern Mariana Islands (CNMI) from the NRLM diesel fuel sulfur standards and associated requirements. We also are excluding these territories from the tier 4 nonroad engine emissions standards, and other requirements associated with those emission standards. The territories will continue to have access to new nonroad diesel engines and equipment using pre-tier 4 technologies, at least as long as manufacturers choose to market those technologies. In the future, if manufacturers choose to market nonroad diesel engines and equipment only with tier 4 emission control technologies, we believe the market will determine if and when the territories will make the investment needed to obtain and distribute the diesel fuel necessary to support these technologies.

We are also requiring that all nonroad diesel engines and equipment for these territories be certified and labeled to the applicable requirements—either to the previous-tier standards and associated requirements under this exclusion, or to the Tier 4 standards and associated requirements applicable for the model year of production under the nationwide requirements of today's action. The engines would still be emissions warranted, as otherwise required under the CAA and EPA regulations. Special recall and warranty considerations due to the use of excluded high sulfur fuel would be the same as those for Alaska during its exemption and transition periods for highway diesel fuel and for these territories for highway diesel fuel (*see* 66 FR 5086, 5088, January 18, 2001).

To protect against circumvention of the emission requirements applicable to the rest of the U.S., we are restricting the importation of nonroad engines and equipment from these territories into the rest of the U.S. After the 2010 model year, nonroad diesel engines and equipment certified under this exclusion for sale in American Samoa, Guam and the Commonwealth of the Northern Mariana Islands will not be permitted entry into the rest of the U.S.

b. Why Are We Treating These Territories Uniquely?

Like Alaska, these territories are currently exempt from the 500 ppm sulfur standard for highway diesel fuel. Unlike Alaska, they are also exempt from the new highway diesel fuel sulfur standard effective in 2006 and the new highway vehicle and engine emission standards effective beginning in 2007 (*see* 66 FR 5088, January 18, 2001).

Section 325 of the CAA provides that upon request of Guam, American Samoa, the Virgin Islands, or the Commonwealth of the Northern Mariana Islands, we may exempt any person or source, or class of persons or sources, in that territory from any requirement of the CAA, with some specific exceptions. The requested exemption could be granted if we determine that compliance with such requirement is not feasible or is unreasonable due to unique geographical, meteorological, or economic factors of the territory, or other local factors as we consider

significant. Prior to the effective date of the current highway diesel fuel sulfur standard of 500 ppm, the territories of American Samoa, Guam and the Commonwealth of the Northern Mariana Islands petitioned us for an exemption under section 325 of the CAA from the sulfur requirement under section 211(i) of the CAA and associated regulations at 40 CFR 80.29. We subsequently granted the petitions.[107] Consistent with this decision, in our January 18, 2001 highway rule (66 FR 5088), we determined that the 2007 heavy-duty engine emission standards and 2006 diesel fuel sulfur standard would not apply to these territories.

Compliance with the NRLM diesel fuel sulfur standards would result in major economic burden on the territories. All three of these territories lack internal petroleum supplies and refining capabilities and rely on long distance imports. Given their remote location from Hawaii and the U.S. mainland, most petroleum products are imported from east rim nations, particularly Singapore. Australia, the Philippines, and certain other Asian countries are beginning to consider and in some cases implement lower sulfur diesel fuel standards. However, it is not clear that supply, especially of 15 ppm sulfur diesel fuel, would be possible to these territories.

Furthermore, compliance with new 15 ppm sulfur requirement for highway diesel fuel beginning in 2006 and today's 15 ppm sulfur requirement for NRLM diesel fuel beginning in 2010 (or the 500 ppm sulfur requirement for NRLM diesel fuel beginning 2007) would require construction of separate storage and handling facilities for a unique grade of diesel fuel for highway and nonroad purposes, or use of 15 ppm sulfur diesel fuel for all diesel applications to avoid segregation. Either of these alternatives would require importation of 500 and 15 ppm sulfur diesel fuel from Hawaii or the U.S. mainland, and would significantly add to the already high cost of diesel fuel in these territories, which rely heavily on U.S. support for their economies. At the same time, it is not clear that the environmental benefits in these areas would warrant this cost. Therefore, we are not applying the fuel and engine standards to these territories.

The Caribbean Petroleum Corporation (CPC) commented that the proposed nonroad diesel rule would result in a major economic burden for Puerto Rico, the environmental benefits do not warrant the cost, and that Puerto Rico should be exempt. However, the CPC did not include any cost or environmental information to support its claims. We have no reason to believe that the costs of the NRLM diesel fuel program in Puerto Rico will be significantly greater than that of the U.S. For example, Puerto Rico is close to the U.S. mainland, and to South American and Central American suppliers of fuel to the U.S. mainland, and therefore has ready access to nearby fuel supplies that meet U.S. requirements. Similar to the fuel distribution system in the rest of the country, the fuel distribution system in Puerto Rico is geared to separate fuel handling and storage facilities for highway and non-highway diesel fuels. Today's rule will require additional segregation for the NRLM diesel fuels, but no differently for Puerto Rico than for the U.S. Nevertheless, to avoid that additional fuel segregation, Puerto Rico could substitute highway fuel for use in NRLM diesel engines and equipment. We also believe that the important air quality

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[107] *See* 57 FR 32010, July 20, 1992 for American Samoa; 57 FR 32010, July 30, 1992 for Guam; and 59 FR 26129, May 19, 1994 for CNMI.

benefits to be realized by today's rule for the four million people in Puerto Rico should not be significantly different than those for the rest of the country. Consequently, today's rule includes Puerto Rico in the NRLM diesel fuel program.

D. NRLM Diesel Fuel Program Design

In addition to specifying the sulfur standards and the implementation dates when the standards take effect, the diesel fuel program compliance provisions must be designed and structured carefully to achieve the overall principles of the program. Specifically, the health and welfare benefits of the NRLM diesel fuel and the highway diesel programs, and the need for widespread availability of 15 ppm sulfur highway diesel fuel must be maintained. The program benefits and fuel availability will only happen if the NRLM diesel fuel program is designed such that the amount of 15 ppm sulfur fuel expected to be produced under the highway diesel fuel program is in fact produced and that 500 ppm highway fuel is not overproduced. Likewise, the benefits of the NRLM diesel fuel sulfur standards adopted today will only be achieved if the program is designed to ensure that the volume of diesel fuel consumed by NRLM diesel engines is matched by the supply of NRLM diesel fuel produced to the appropriate low sulfur levels. At the same time, promoting the efficiency of the distribution system calls for fungible distribution of physically similar products, and minimizing the need for product segregation.

As discussed below, the situation faced in 1993 when EPA first regulated the sulfur content of highway diesel fuel parallels some of the issues that EPA needed to address in today's rule. Prior to the implementation of the 500 ppm sulfur standard for highway diesel fuel in 1993, most No. 2 distillate fuel was produced to essentially the same specifications, shipped fungibly, and used interchangeably by highway diesel engines, nonroad diesel engines, locomotive and marine diesel engines, and heating oil applications. Beginning in 1993, highway diesel fuel was required to meet a 500 ppm sulfur cap and was segregated from other distillate fuels as it left the refinery by the use of a visible level of dye solvent red 164 in all non-highway distillate. At about the same time, the Internal Revenue Service (IRS) similarly required non-highway diesel fuel to be dyed red to a much higher concentration prior to retail sale to distinguish it from highway diesel fuel for excise tax purposes. Dyed non-highway fuel is exempt from this tax. This splitting of the distillate pool necessitated changes in the distribution system to ship and store the now distinct products separately. In some parts of the country where the costs to segregate non-highway diesel fuel from highway diesel fuel could not be justified, both fuels have been produced to highway specifications.[108]

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[108] Diesel fuel produced to highway specifications but used for non-highway purposes is referred to as "spill-over." It leaves the refinery gate and is fungibly distributed as if it were highway diesel fuel, and is typically dyed at a point later in the distribution system. Once it is dyed it is no longer available for use in highway vehicles, and is not part of the supply of highway fuel.

1. Requirements During the First Step of the Fuel Program

EPA is adopting specific compliance provisions during the first step of today's NRLM diesel fuel sulfur control program for three reasons. The first is to maintain the integrity of the highway diesel program, while allowing the efficient distribution of highway and NRLM diesel fuel. Since 500 ppm sulfur highway diesel fuel allowed under the highway diesel fuel program's Temporary Compliance Option (TCO) and NRLM diesel fuel meeting today's 500 ppm sulfur standard will be physically the same, it would be impossible to maintain the benefits and program integrity of the highway diesel fuel program without some means of differentiating highway diesel fuel from NRLM diesel fuel.

Continuing the current practice of dyeing NRLM diesel fuel at the refinery gate and requiring that it be segregated throughout the distribution system is not a practical way to differentiate NRLM diesel fuel from highway fuel. At the same time, allowing the unrestricted fungible distribution of highway and NRLM diesel fuel with the same sulfur level risks the loss of important benefits of the highway program. For example, if a refiner produced all 500 ppm sulfur fuel and designated it as NRLM diesel fuel, that refiner would have no obligation to produce any 15 ppm sulfur highway diesel fuel. Without an effective way of limiting the use in the highway market of 500 ppm sulfur diesel fuel produced as NRLM diesel fuel, much more 500 ppm sulfur fuel could, and likely would find its way into the highway market than would otherwise happen under the current highway program. This would displace 15 ppm sulfur diesel fuel that would have otherwise been produced. This likely series of events would circumvent the intent of the highway program's TCO and sacrifice some of the resulting PM and SO_2 emission benefits of the overall highway diesel program. If this occurred to any significant degree, it could also undermine the integrity of the highway program by threatening the availability of 15 ppm sulfur diesel fuel nationwide for the vehicles that need it. This is no longer a concern after 2010, when all highway diesel fuel is required to meet a 15 ppm sulfur standard.

The second reason is to maintain the integrity of the NRLM diesel fuel program, while allowing the efficient distribution of NRLM diesel fuel and heating oil where they have similar sulfur levels. By establishing new sulfur standards for NRLM diesel fuel but not heating oil, today's program creates the need to distinguish the fuel used for these two purposes. Currently, there is no grade of diesel fuel which is produced and marketed as a distinguishable grade for NRLM diesel engine uses. It is typically produced and shipped fungibly with other distillate used for heating oil purposes, and it is all dyed red in accordance with EPA and IRS regulations. Because today's rule includes small refiner and credit provisions that allow the limited production of high sulfur (greater than 500 ppm) NRLM diesel fuel through 2010, it is not possible to rely on sulfur content alone to differentiate NRLM diesel fuel from heating oil during the first step of the program. Without adequate controls, a refiner could choose not to desulfurize any of its fuel that is destined for the NRLM diesel fuel market, instead designating that volume as heating oil at the refinery gate. This fuel, ostensibly manufactured for use as heating oil could be misdirected for use in NRLM diesel equipment, and would be indistinguishable from legal high sulfur NRLM

diesel fuel produced by small refiners and/or through the use of credits. This could substantially reduce the environmental benefits of today's rule.

After 2010, when the 15 ppm sulfur standard for NR diesel fuel goes into effect, small refiner and credit NR fuel must meet a 500 ppm standard. Therefore, after 2010 NRLM diesel fuel can be distinguished from high sulfur (greater than 500 ppm) home heating fuel based on sulfur content. However, 500 ppm NR (small refiner, credit) produced from June 1, 2010 through May 31, 2012, and 500 ppm NRLM (small refiner, credit) diesel fuel produced from June 1, 2012 through May 31, 2014, could not be distinguished from heating oil produced to meet a similar 500 ppm sulfur limit. Likewise, from June 1, 2010 to June 1, 2012, 500 ppm NR (small refiner, credit) diesel fuel and LM diesel fuel need to be distinguished from each other, so that diesel fuel produced as 500 ppm LM is not later misdirected to the NR diesel market. Such misdirected 500 ppm sulfur LM diesel fuel would be indistinguishable from legal 500 ppm sulfur NR diesel fuel, reducing the environmental benefits of today's rule. These various 500 ppm fuels could not be distinguished based on sulfur level. As previously discussed, the situation which was faced in 1993 regarding the need to differentiate 500 ppm sulfur highway diesel fuel from other diesel fuel is similar to the need today to differentiate highway diesel fuel, NRLM diesel fuel, and heating oil.

The third reason is to maintain the integrity of the anti-downgrading requirements in the highway diesel program. The highway diesel program requires that each entity in the distribution system downgrade no more than 20 percent of the 15 ppm sulfur highway diesel fuel for which it assumes custody to 500 ppm sulfur highway diesel fuel. These provisions are necessary to ensure the widespread availability of 15 ppm sulfur diesel fuel for use in model year 2007 and later highway vehicles, in which the use of 15 ppm sulfur fuel is essential to facilitate the projected emissions benefits of the highway program. The highway program placed no restrictions on the volume of highway diesel fuel that could be downgraded to NRLM diesel fuel. Under the proposed rule there would be no way to distinguish 500 ppm sulfur NRLM diesel fuel from 500 ppm sulfur highway diesel fuel downstream of the refinery. Therefore, to preserve the integrity of the highway program, the proposal would have made the highway program's anti-downgrade requirements more stringent by also restricting downgrades to 500 ppm sulfur NRLM diesel fuel. We received several negative comments on this proposed restriction. The compliance and record keeping requirements finalized to address the two concerns discussed above, can be utilized to facilitate the implementation of the highway program's anti-downgrading requirements without the need to further restrict downgrading. As a result, today's rule also contains several modifications which clarify the anti-downgrading provisions of the highway diesel program.

The requirements described below will help ensure that the projected benefits of the highway diesel program and of today's NRLM diesel program are achieved.

a. Ensuring Refiner Production Volumes of 15 ppm Sulfur Highway Diesel Fuel are Consistent with the Highway Rule's 80/20 Requirement

To avoid adding unnecessary cost to the fuel distribution system, we proposed that the current requirement of dyeing non-highway distillate fuels at the refinery gate become voluntary as of June 1, 2006.[109] As discussed in the proposal, continuing to require that NRLM diesel fuel and heating oil contain a visible trace of red dye at the refinery gate would allow for simple enforcement of the highway standards throughout the duration of the highway program's TCO. Clear, undyed diesel fuel would have to meet the 80/20 ratio of 15 ppm to 500 ppm sulfur highway diesel fuel, and dyed fuel could only be used in NRLM diesel equipment or as heating oil. Continuing the current dye provisions would therefore ensure that the intended benefits of the highway program are achieved. However, maintaining this dye distinction would also require segregation of a new grade of dyed 500 ppm sulfur NRLM diesel fuel throughout the entire distribution system. The costs of requiring segregation of two otherwise identical fuels throughout the entire distribution system could be quite substantial.[110] Comments on the proposed rule confirmed EPA's assessment that the ability of the fuel distribution system to distribute these fuels fungibly is essential, since segregating the fuels could result in substantial additional transportation costs and necessitate additional storage tanks throughout the system.

The NPRM invited comment on two alternative approaches to ensure that refiner production of 15 ppm sulfur highway diesel fuel met the highway rule's 80/20 requirement; the "refiner baseline" approach, and the "designate and track" approach. The baseline approach is essentially a constraint on the sulfur levels of the various distillate fuel products a refiner produces, based on historical production volumes. Fuel with similar sulfur levels could then be fungibly distributed with only limited controls on the downstream distribution system. The designate and track approach requires that a refiner designate into which market discrete volumes of the distillate fuels it produces must be sold, without any consideration of historical production volumes. The fuel must then be tracked through the distribution system and sold only for its designated purpose (or a purpose that requires less control). As with the baseline approach, diesel fuel with similar sulfur levels could be fungibly shipped up to the point of distribution from a terminal where off-highway diesel fuel must be dyed red pursuant to IRS requirements to indicate its tax exempt status.

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[109] The IRS requirements concerning dyeing of non-highway fuel prior to sale to consumers are not changed by this rulemaking.

[110] Under the highway program the potential exists to add a third grade of diesel fuel in an estimated 40 percent of the country, and we projected one-time tankage and distribution system costs of $1.05 billion to accomplish this. Using similar assumptions, to add a second 500 ppm grade nationwide would cost in excess of $2 billion. This assumes that the capability exists to add such new tankage.

We proposed the baseline approach because, in the absence of a red dye requirement at the refinery-gate for NRLM diesel fuel, we expected that it would: 1) allow for the fungible distribution of 500 ppm sulfur highway and NRLM diesel fuel; 2) ensure the enforceability of the highway diesel fuel and NRLM diesel fuel standards; 3) maintain the projected production volume of 15 ppm sulfur highway diesel fuel; 4) allow refinery production of 500 ppm sulfur NRLM diesel fuel and heating oil to remain flexible to meet market demand; and 5) enable the efficient distribution of diesel fuel while imposing the least burden on the parties in the fuel production and distribution system. In the proposal, we also discussed how a refiner's baseline would be set, and invited comment on ways to account for changes refiners might make from their historical production practices in response to the highway diesel program.

In the NPRM, we expressed concerns that a designate and track approach would raise significant workability and enforceability issues and therefore might not maintain the integrity of highway and NRLM diesel fuel sulfur programs. Our concerns about the workability and enforceability of a designate and track approach amplified potential concerns regarding whether the approach might reduce the volume of 15 ppm sulfur diesel fuel required to be produced under the highway diesel program, leading to a reduction in the environmental benefits of the highway diesel program and calling into question the availability of 15 ppm sulfur diesel fuel. We were also concerned about whether this approach would place too much burden on the numerous entities in the fuel distribution system, as compliance was focused on downstream parties. While the designate and track approach provided greater production flexibility to refiners than the baseline approach, it appeared to increase the burden and restrictions on downstream parties.

Of the approaches discussed in the NPRM, we expected that the baseline approach would provide the best mechanism to achieve the fuel program goals described at the beginning of this section. Since the proposal, we have comprehensively evaluated the advantages and disadvantages of both approaches. Based on this review, we now believe that a baseline approach would produce significant adverse problems because of its overly restrictive impact on the ability of fuel producers and distributors to efficiently respond to the myriad and daily needs of the markets for highway and NRLM diesel fuel. Implementation of the approach could also produce an unintended bias that would tend to reduce the benefits of the highway program and reduce the availability of 15 ppm sulfur highway diesel fuel. At the same time, our review of the approaches shows that the designate and track approach can be implemented in an enforceable manner and likely would not cause a reduction in the environmental benefits of the highway diesel program or adversely impact the widespread availability of 15 ppm sulfur highway diesel fuel. Our evaluation of these alternate approaches is discussed in more detail in the following sections.

i. Proposed Refiner Baseline Approach

Under the refiner baseline approach, we proposed that from June 1, 2007 through May 31, 2010, any refiner or importer could choose to distribute its 500 ppm sulfur NRLM and highway diesel fuels fungibly without adding red dye at the refinery gate. Refiners and importers who elect to distribute these fuels fungibly would need to establish a non-highway distillate baseline,

defined as a percentage of its total distillate fuel production volume based on historical production data. For future production purposes, this percentage of the volume of diesel fuel produced would have to either meet the 500 ppm sulfur NRLM diesel fuel sulfur standard or be marked as heating oil. All the remaining production of diesel fuel would have to meet the requirements of the highway fuel program (i.e., 80 percent of this fuel would have to meet a 15 ppm sulfur cap). Refiners not wishing to participate in the baseline approach would have to dye all of their 500 ppm sulfur NRLM diesel fuel at the refinery. However, we anticipated that few refiners would opt to dye 500 ppm sulfur NRLM diesel fuel, other than the volumes that they dispense from their own racks, since this would eliminate the ability to fungibly distribute 500 ppm sulfur highway and NRLM diesel fuels.

Since the publication of the proposed rule, we have developed a better understanding of refiner concerns about the constraints associated with the baseline approach. Specifically, it is now clear that individual refiners would be significantly constrained by the baseline approach from efficiently responding to changes in contract arrangements with their clients and changes in market demands. Refiners commented that they win and lose contracts on a daily basis and that depending on which contracts they secure, they may not be able to comply with their baseline. Specific concerns were raised regarding the ability of refiners to compensate for the loss of export contracts and to respond to spikes in the demand for heating oil which periodically result from an unexpectedly cold winter. Refiners also related that the constraints under the baseline approach could cause an anti-competitive dynamic between fuel refiners and their customers.

Based on our reevaluation of the baseline approach and the information gathered from the public comments, it is now clear that the constraints on the slate of fuels that a refiner produces under the baseline approach could interfere with a refiner's ability to meet market demands, which in turn could result in supply shortages and increased fuel prices. For example, if a refiner were to lose an export contract for high sulfur diesel fuel, the baseline approach could prevent that refiner from seeking to market that product domestically. This could impact the overall supply of diesel fuel since the refiner may not have sufficient facilities to desulfurize diesel fuel. Also, knowing that losing such an export contract would leave the refiner with no ability to market its fuel domestically could give the refiner's export client an undue advantage during contract negotiations.

In the case of a spike in heating oil demand due to an usually cold winter, the baseline approach would limit a refiner's ability to produce additional volumes of high sulfur distillate fuel beyond the volume established under its baseline. Refiners that were limited in their ability to produce additional high sulfur fuel could choose to supply low sulfur diesel fuel to the heating oil market. However, they may not have sufficient hydrotreating capacity to do so. This could limit their ability to respond to a supply shortage.

The proposed rule suggested various potential modifications to the baseline approach to address refiner concerns regarding the associated constraints on the slate of fuels they produce. We received comments on the potential modifications discussed in the NPRM as well as other

potential changes to the baseline approach. Some commenters suggested that if EPA were to finalize a baseline approach, refiners should be able to apply to EPA for a yearly adjustment to their baseline based on annual demand forecasts. Even with such flexibility, refiners still concluded that in many cases they would likely be forced to dye their fuel instead. For fuel distributors, having refiners dye their NRLM diesel fuel presented an unacceptable situation due to the need to distribute another grade of fuel. As a result, all comments from the refining and fuel distribution community were in agreement that the baseline approach may be unworkable.

Based on our review of the comments and our discussions with fuel producers and distributions, it has become clear that none of the potential modifications to the baseline approach would adequately compensate for the inherent inflexibility of requiring refiners to comply with set production ratios. Even if EPA were to adjust such ratios on an annual basis, refiners might need to approach EPA for an interim adjustment if their contractual agreements changed or if market demand shifted unexpectedly. The process of evaluating requests for baseline adjustments could be very burdensome to the industry and to EPA, and EPA would unlikely be able to respond quickly enough to changing market conditions.

More importantly, all of the potential alternatives that we might implement to mitigate the constraints of the baseline approach could potentially undermine the environmental benefits of the highway program. Such alternatives all would involve granting allowances to some refiners to produce additional volumes of non-highway fuels above the set baseline to facilitate a refiner meeting the market demand for such fuels. At the same time, it would not be possible for EPA to reduce the ability of other refiners to produce non-highway fuel who may have lost these markets. Therefore, for such alternatives to be effective in responding to changing market conditions, an unintended downward bias would result regarding the required production of 15 ppm sulfur highway diesel fuel.

Even without any changes we discovered from the highway diesel program pre-compliance reports that the proposed baseline approach has a downward bias that could result in a reduction in the volume of 15 ppm sulfur diesel fuel produced under the highway diesel program.[111] We proposed that refiners could choose to calculate their off-highway baseline using either an average of 2003 through 2005 production data or 2006 production data. Providing the option for a 2006 baseline was necessary because a number of refiners will be changing the slate of fuels that they produce in response to the highway diesel rule which becomes effective in 2006. While the highway diesel pre-compliance reports indicate an overall increase in production volume, they also indicate that 40 percent of highway diesel refiners will decrease the volume of highway diesel fuel they produce. If all of these refiners were to take a 2006 baseline to determine the volume of 15 ppm sulfur diesel fuel they would be required to produce, a substantial drop in the total volume of 15 ppm sulfur diesel fuel produced could result.

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[111] "Summary and Analysis of the Highway Diesel Fuel 2003 Pre-compliance Reports," EPA 420-R-03-103, October 2003.

The pre-compliance reports indicate that the other 60 percent of refiners will be increasing the volume of highway diesel fuel they produce. We projected that these shifts in the slate of fuel products that refiners produce would have an overall positive impact on diesel fuel supply. However, refiners that increase the volume of highway fuel they produce would likely chose to calculate their baseline using their lower 2003-2005 production volumes. Doing so would result in a lower percentage of their distillate fuel that would be required to be produced for highway diesel use, and subject to a 15 ppm sulfur standard.

The volume of spillover could also be reduced if refiners were to dye 500 ppm sulfur diesel they manufactured to meet anticipated NRLM diesel fuel demand in order to avoid needing to comply with the baseline approach. Many refiners commented that they considered the baseline approach so unworkable and onerous that they would choose to dye all of their 500 ppm sulfur NRLM diesel fuel at the refinery gate. This could force some parts of the distribution systems which had previously not carried two grades of diesel fuel for highway and off-highway uses to begin doing so.

In summary, we are not finalizing the proposed baseline system because we believe –

1. It could unnecessarily constrain refiners ability to meet market demands, encouraging them to dye 500 ppm sulfur NRLM diesel fuel at the refinery resulting in an added burden to the distribution system;

2. It could create a bias that could result in a loss in the volume of 15 ppm sulfur highway diesel fuel produced, and the options to remove these market constraints would only increase the bias to reduce the volume of 15 ppm sulfur highway diesel fuel; and

3. The baseline approach would not ensure that the environmental benefits of the 2007 highway diesel program would be maintained.

ii. Designate and Track Approach

At the time of the NPRM, we invited comment on an alternative to the baseline approach called the "designate and track" approach. Under the envisioned designate and track approach, refiners and importers would designate the volumes of 500 ppm sulfur diesel fuel they produce/import as either highway or NRLM diesel fuel and would ship them fungibly. These designations would follow the fuel through the distribution system and be used to restrict the sale of 500 ppm sulfur NRLM diesel fuel from the highway market. While we sought comment on various forms of the designate and track approach, we also expressed serious reservations regarding its workability, enforceability, impact on the benefits of the highway rule, and constraints on the distribution system. For example, at the time of the proposal, refiners supported a designate and track approach where certain parts of the distribution system (e.g., pipelines) did not have to report. EPA believed that such an approach was unenforceable.

Refiners were also supporting the designate and track approach as an option for refiners to choose in addition to the baseline approach. However, EPA believed that the two approaches were incompatible.

As noted in the proposal, the designate and track approach allows maximum flexibility for refiners and importers, but EPA had concerns that the volume reconciliation requirements would inappropriately restrict the flexibility of downstream parties to respond to market changes. EPA also had concerns that it would reduce the amount of 15 ppm spillover from the highway market, reducing the environmental benefits of that rule.

Since the proposal, we received extensive input both in the written comments and through in-depth meetings with representatives of all segments of the fuel distribution industry on how the designate and track system might be structured to provide the needed compliance oversight without placing an undue burden on industry. Refiners now agree that the designate and track approach should not be an option for refiners in addition to the baseline approach, and support it as a stand alone approach. All parties in the fuel distribution system have also now expressed support for the record keeping and reporting requirements associated with tracking designated fuel volumes through each custodian in the distribution chain until the fuel leaves the terminal either taxed or dyed. Furthermore, commenters from all segments of the fuel distribution industry from the refiner through to the terminal stated that the information needed to support the designate and track approach is already kept as part of normal business practices. Commenters stated that only modest upgrades in their record keeping procedures would be needed to compile the needed information and that preparing the necessary reports would not represent a significant burden. Thus, our concerns that a designate and track approach might represent a large burden to fuel distributors were unfounded.

In addition, we have developed appropriate solutions to the various open questions and issues that we had with the designate and track approach at the time of the proposal. In the proposal it was unclear how a designate and track approach would be structured to account for the swell in highway diesel fuel volumes in the winter that results from downstream kerosene blending to improve cold flow properties. Without an adequate control mechanism, normal swell in downstream highway diesel fuel volumes in the North due to kerosene blending during winter months could mask the inappropriate shifting of NRLM-designated 500 ppm sulfur fuel to the highway diesel pool. We have developed an appropriate mechanism to address this situation as described in section IV.D.3.

In the proposal, we also expressed concerns regarding how normal volumetric fluctuations in the distribution system such as those caused by product downgrading in pipelines could be adequately accounted for under a designate and track system so that such fluctuations would not mask the inappropriate shifting of 500 ppm sulfur NRLM diesel fuel to the highway pool. We have subsequently developed a periodic volume account balance system to account for such fluctuations.

Through discussions with terminal operators, we have also resolved concerns expressed in the NPRM that a designate and track approach might limit a terminal operator's ability to respond to shifts in demand for 500 ppm sulfur highway versus NRLM diesel fuel. To avoid this potential problem today's rule allows terminal operators and others to switch the designation of 500 ppm sulfur NRLM diesel fuel to highway diesel fuel on a temporary basis but not on a cumulative basis over time. This will allow terminal operators to sell NRLM designated 500 ppm sulfur fuel into the highway market provided that they later sell the same volume of highway-designated 500 ppm sulfur fuel into the NRLM market. To ensure that 500 ppm sulfur NRLM diesel fuel is not inappropriately shifted into the highway diesel pool, terminal operators will need to demonstrate that the volume of 500 ppm sulfur highway diesel fuel they delivered is less than or equal to the volume received.

In the NPRM, we stated that determining the responsible party for a violation of the restriction against shifting 500 ppm sulfur NRLM diesel fuel into the highway pool would be difficult under a designate and track approach because a number of parties in the distribution chain take custody of the fuel without taking ownership. However, this concern can be addressed by structuring the provisions to hold the custodian of the fuel accountable for any such violation that takes place while the fuel is in their custody. Review of electronic data submitted from all custodians in the highway and NRLM diesel fuel distribution chain will reveal the custodian responsible for a violation. By comparing such data on the hand-offs of designated fuel volumes between all adjacent pairs of custodians in the distribution chain for discrepancies, we can identify any party responsible for inappropriately shifting volumes of 500 ppm sulfur fuel designated for use in NRLM equipment to the highway market. Many terminals do not take ownership of the fuel that they handle. Terminals that lease storage tanks to multiple owners will need to enter into contractual agreements with their tenants to ensure that they understand their obligations as a custodian of designated fuel and do not inappropriately change the designation of fuels stored in such leased tanks.

An effective enforcement and compliance assurance program must include the ability to rapidly and accurately review the large amount of data on the hand-offs of designated fuel volumes for discrepancies. This can be accomplished if all parties report electronically to a database which can reconcile hand-off volumes between all parties in the distribution chain in an automated fashion. All segments in the fuel distribution system are now in support of providing the necessary information to such an electronic reporting system. We have conducted a review of the Agency resources that would be needed to compile the industry reports on the transfer of designated fuel volumes, perform quality assurance on these data, and to perform the necessary analysis of the database to discover potential violations. Our review indicates that the reporting forms can be standardized and the review process automated in such a fashion as to minimize the Agency resource requirements, while at that same time ensuring the quality of the data and completeness of the review process. In light of the above discussion, we are now convinced that a designate and track approach can be designed to meet our enforcement and compliance assurance needs under today's rule.

In addition to concerns regarding the workability and enforceability of a designate and track approach, the NPRM expressed concerns that application of such an approach could reduce the benefits of the highway diesel program by reducing the amount of highway diesel fuel that is used in nonroad equipment due to the logistical constraints in the distribution system ("spillover"). Specifically, it was thought that the opportunity to fungibly ship batches of 500 ppm sulfur NRLM diesel fuel and 500 ppm sulfur highway diesel fuel might allow refiners to supply highway and NRLM diesel fuel to markets where they would otherwise have supplied just highway fuel for both purposes. Our reevaluation since the proposal indicates that this is not a significant concern. As noted earlier, there are currently substantial regions of the country where only highway diesel fuel is supplied by bulk shipments to both the highway and NRLM markets due to the high costs associated with segregating an additional distillate grade in the distribution system.[112] These are the same areas where the majority of spillover occurs today. After the highway diesel program becomes effective in 2006, we project that only 15 ppm sulfur highway diesel fuel will be supplied in bulk shipments to both the highway and NRLM markets in most of these same areas. Although 500 ppm sulfur highway diesel fuel could be shipped in bulk to these areas through 2010 under the highway program's TCO, the potential demand for such fuel and for 500 ppm sulfur NRLM diesel fuel would not be sufficient to justify the cost of segregating an additional grade of 500 ppm sulfur diesel fuel in these areas for a short period of time. The designate and track approach does not impact the costs of segregation, and therefore is not expected to change distribution patterns that are based on these costs.

After 2010, when 500 ppm sulfur highway fuel no longer exists, the total volume of 500 ppm sulfur diesel fuel in the distribution system will be substantially reduced, and there will be even less incentive to distribute an additional grade of 500 ppm sulfur diesel fuel in bulk. Therefore, the only areas where substantial flexibility will exist under today's program to supply either highway or NRLM diesel fuel to the NRLM market is in areas where this flexibility exists today. Despite this flexibility in the current regulations, spillover currently still occurs. Therefore, we project that there will be little additional potential due to today's rule for refiners to reduce highway spillover into the NRLM market under a designate and track approach and that such spillover levels would not be significantly reduced from historical levels. In contrast, as discussed above, we now believe that the baseline approach would have resulted in a significant loss of 15 ppm diesel production.

Furthermore, concerns regarding a potential reduction in the spillover of 15 ppm sulfur highway diesel into the NRLM markets has been lessened by the information provided in the highway program pre-compliance reports. These reports suggest that more than 95 percent of highway diesel fuel will be produced to a 15 ppm sulfur standard beginning in 2006. In calculating the projected benefits of the highway diesel program, we assumed that only 80 percent of highway diesel fuel would meet a 15 ppm sulfur standard. Therefore, the actual benefits of the

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[112] This highway diesel fuel would meet the currently-applicable 500 ppm sulfur standard for highway diesel fuel.

highway program will be substantially greater than estimated if the projections in the pre-compliance reports are realized.

Based on the above discussion, we believe that the concerns regarding the designate and track approach's workability, enforceability, and ability to preserve the benefits of the highway program and today's NRLM diesel fuel program have been satisfactorily resolved.

b. Ensuring that Heating Oil is not Used in NRLM Equipment from June 1, 2007 Through June 1, 2010

i. Use of a Fuel Marker in Heating Oil

To prevent shifting heating oil into the NRLM market, we proposed that a fuel marker be added to heating oil at the refinery gate. We proposed that the presence of the marker required in heating oil would be strictly prohibited in NRLM diesel fuel. As noted earlier, this approach is similar to red dye requirements for high sulfur diesel fuel that were implemented in 1993 to prevent its use as highway diesel fuel subject to the then applicable 500 ppm sulfur standard.

We proposed that the marker be added at the refinery gate rather than at the terminal for several reasons. First, this seemed to be the most efficient and lowest cost option for addition of the marker given that the number of terminals is far greater than the number of refineries.[113] Second, requiring that the marker be present in heating oil when it is introduced into the distribution system would ensure that we could differentiate high sulfur small refiner and credit fuel from heating oil at any point in the system. This approach would provide good assurance that the inability to use fuel sulfur content to differentiate heating oil from high sulfur NRLM diesel fuel produced under the small refiner and credit provisions in today's rule (effective until June 1, 2010) would not provide an opportunity to mask the potential use of heating oil in NRLM equipment. Providing such assurance is an essential element to enable the implementation of the small refiner and credit provisions in today's rule. Lastly, under the proposed baseline approach, there was no other way to ensure that heating oil was not shifted into the NRLM diesel fuel pool during distribution from the refinery/importer to the terminal.

We received numerous comments that the upstream addition of the proposed marker to heating oil would raise significant concerns that the marker might contaminate jet fuel. Commenters stated that this would represent a substantial safety concern unless the proposed marker was proven not to adversely impact the quality of jet fuel and the operation of jet engines.

The designate and track approach described above for 500 ppm sulfur NRLM diesel fuel, however, also provides an effective means to address concerns about the use of the fuel marker. By extending the designate and track approach to high sulfur NRLM diesel fuel and heating oil, these otherwise identical fuel grades can be tracked down to the terminal, and the marker then can

[113] Additional injection equipment will be required to inject the heating oil marker.

be added at the terminal instead of at the refinery gate. Going beyond the terminal with designate and track is not feasible give the breadth and nature of entities involved.[114] As a result, the marker is still required downstream of the terminal. However, shifting the point of marker addition downstream to the terminal should eliminate any significant opportunity for jet fuel contamination. Subsequent comments and discussions appear to have confirmed this.[115] EPA will continue to work with other federal agencies, including FAA and DoD, and to follow ongoing research and studies regarding the effect of dyes and markers on jet fuel, particularly potential contamination that could have an adverse impact on the safe operation of aircraft. We will keep abreast of the ASTM, CRC, FAA, IRS, and EU activities regarding the evaluation of the use of SY-124 and commit to a review of our use of SY-124 under today's rule based on these findings. If alternative markers are identified that do not raise concerns regarding the potential contamination of jet fuel, we will initiate a rulemaking to evaluate the use of one of these markers in place of SY-124.[116]

We also received a number of comments expressing concern over the inability of the proposed marker to be detected using the standard simple test used today to detect contamination with red dye.[117] The marker finalized by today's rule does not provide visual evidence of its presence. However, if the marker is added at the terminal it will only be present in heating oil when red dye is also present. The fact that heating oil will be dyed red pursuant to IRS requirements before it leaves the terminal will enable jet fuel distributors to continue to use the "white bucket test" to detect heating oil contamination, and hence marker contamination of jet fuel. Today's rule also includes a stand-alone requirement that any fuel to which the fuel marker is added must also contain visible evidence of red dye.[118]

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[114] Including every end-user of heating oil.

[115] Letter to Paul Machiele, EPA, from James Thomas, American Society for Testing and Materials (ASTM), entitled "Withdrawal of ASTM Request," January 19, 2004. In this letter ASTM withdraws its request for a postponement of the finalization of the heating oil marker requirements in today's rule. See section V.E regarding the selection of the heating oil marker required in today's rule.

[116] See section VIII.H. of today's preamble.

[117] To test for contamination, jet fuel marketers typically fill a white five gallon bucket with jet fuel. The presence of a pink tinge to the light straw colored jet fuel indicates that the fuel has been contaminated with fuel that contains red dye.

[118] If IRS amends its red dye requirements, EPA will also seriously consider amending the fuel marker and associated red dye requirements contained in today's rule. See section V.E. of today's preamble.

ii. Provisions to Ensure Heating Oil is not Used in NRLM Equipment in the Northeast and Mid-Atlantic

In the Northeast, heating oil will continue to be distributed in significant quantities after implementation of the NRLM diesel fuel program. Discussions with terminal operators in the Northeast, and other representatives of heating oil users and distributors, revealed concerns that the proposed heating oil marker requirement would represent a substantial new burden on terminal operators and users of heating oil. Terminal operators stated that the cost of installing new injection equipment would be burdensome, and that the cost of the marker itself would be significant given the large volume of heating oil used in the Northeast. They also stated that they did not expect any small refiner or credit fuel to be used in the Northeast, and that consequently, the marker requirement was not needed in this area. They suggested that if we prohibited the sale of small refiner and credit fuel in PADD I , this area could be exempted from the heating oil marker requirement.

We evaluated the viability of avoiding the heating oil marker requirement in portions of PADD I and instead enforcing the NRLM diesel fuel standards on the basis of sulfur content alone. The heating oil marker is needed to ensure that heating oil is not sold into the NRLM market as high sulfur NRLM fuel. The marker is needed only if high sulfur NRLM fuels will otherwise be in the market. High sulfur NRLM fuel can be produced under the small refiner and credit provisions, and through the generation of high sulfur NRLM in the distribution system from the downgrading of 500 ppm sulfur NRLM. In evaluating the feasibility of avoiding the heating oil marker, EPA therefore focused on determining the likely production and marketing of these high sulfur NRLM fuels in portions of PADD I in this time frame.

We held in-depth discussions with organizations representing refiners, pipelines, and terminal operators to evaluate this issue. Representatives of non-small refiners including API and NPRA stated that being precluded from selling sulfur credit fuel in the Northeast and Mid-Atlantic would not significantly reduce the intended benefits to refiners of the credit provisions in today's rule. We also spoke with small refiner representatives of and the specific small refiners whose marketing area might include the Northeast and Mid-Atlantic and found that in fact, small refiners were not expected to market fuel in this area. Finally, we evaluated the current and likely future practices in the Northeast and Mid-Atlantic areas for the sale of downgraded fuel generated in the distribution system. We found that this downgraded diesel fuel could easily continue to be sold in the very large and ubiquitous heating oil market that is expected to continue to exist in this region. This avoids any need for additional storage or tankage for both high sulfur and low sulfur NRLM fuels, and fits into the pre-existing market structure for heating oil.

Consequently, unlike the rest of the country, there was little expected need to maintain a high sulfur NRLM market in this part of the country as an outlet for small refiner, credit, or off-specification, downgraded diesel fuel. Based on this input, we concluded that codifying this expected practice and making it enforceable, i.e. not allowing high sulfur fuel to be marketed as NRLM in this area of the country, would be consistent with the current distribution practices in

this area of the country and that the potential impact of taking such an approach on the flexibility offered in the program would be minimal or nonexistent. If we codified it we would no longer need the marker requirement, and the resulting benefits and cost savings to terminals would be substantial. The approach would also simplify and strengthen the enforcement of today's sulfur requirements in this area by allowing EPA to enforce the NRLM standards simply based on the measurement of the sulfur content of the fuel. There would be little expected impact on the environment as this is not expected to change the amount of high sulfur fuel produced from small refiners, credit usage, or downgrade in the distribution system, only the market into which it is sold.

In deciding which parts of PADD I to use this enforcement mechanism, we attempted to minimize the number of terminals that would need to install new injection equipment and the amount of heating oil that would need to be marked, while preserving the benefits of the small refiner and credit fuel provisions in today's rule to the maximum extent possible. To assess the placement of the boundary for the Northeast/Mid-Atlantic area where the marker requirement was waived, we evaluated the magnitude of heating oil demand by state, (see chapter 5 of the RIA) solicited input from the potentially affected parties, evaluated the area supplied by the pipeline distribution systems that are expected to continue to ship heating oil after the implementation of today's rule, evaluated the locations of terminals that are likely to receive bulk shipments of heating oil, evaluated the distribution area of small refiner(s) for high sulfur NRLM diesel fuel, and reviewed heating oil use levels in areas that will have access to bulk shipments of heating oil. Based on our assessment we concluded that defining the Northeast/Mid-Atlantic area as described below would best achieve our goals.[119] In most cases, whole states in PADD 1 were assigned to this "Northeast/Mid-Atlantic" area. This decision was primarily based on the continued high level of heating oil use projected in these states and the lack of significant concern regarding the elimination of the program's flexibilities to produce high sulfur NRLM diesel fuel in these states. A few counties in Eastern West Virginia were also assigned to the Northeast/Mid-Atlantic area based on supply patterns in the area. On the other hand, a number of counties in Western New York and Pennsylvania were not assigned to the Northeast/Mid-Atlantic area due to the need to maintain flexibilities for refiners serving this area.

In summary, the areas excluded from the marker requirement and where the sale of NRLM diesel fuel produced or imported under the credit and hardship provisions or from the downstream downgrade provisions of today's rule is prohibited are: North Carolina, Virginia, Maryland, Delaware, New Jersey, Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, Maine, Washington D.C., New York (except for the counties of Chautauqua, Cattaraugus, and Allegany), Pennsylvania (except for the counties of Erie, Warren, Mc Kean, Potter, Cameron, Elk,

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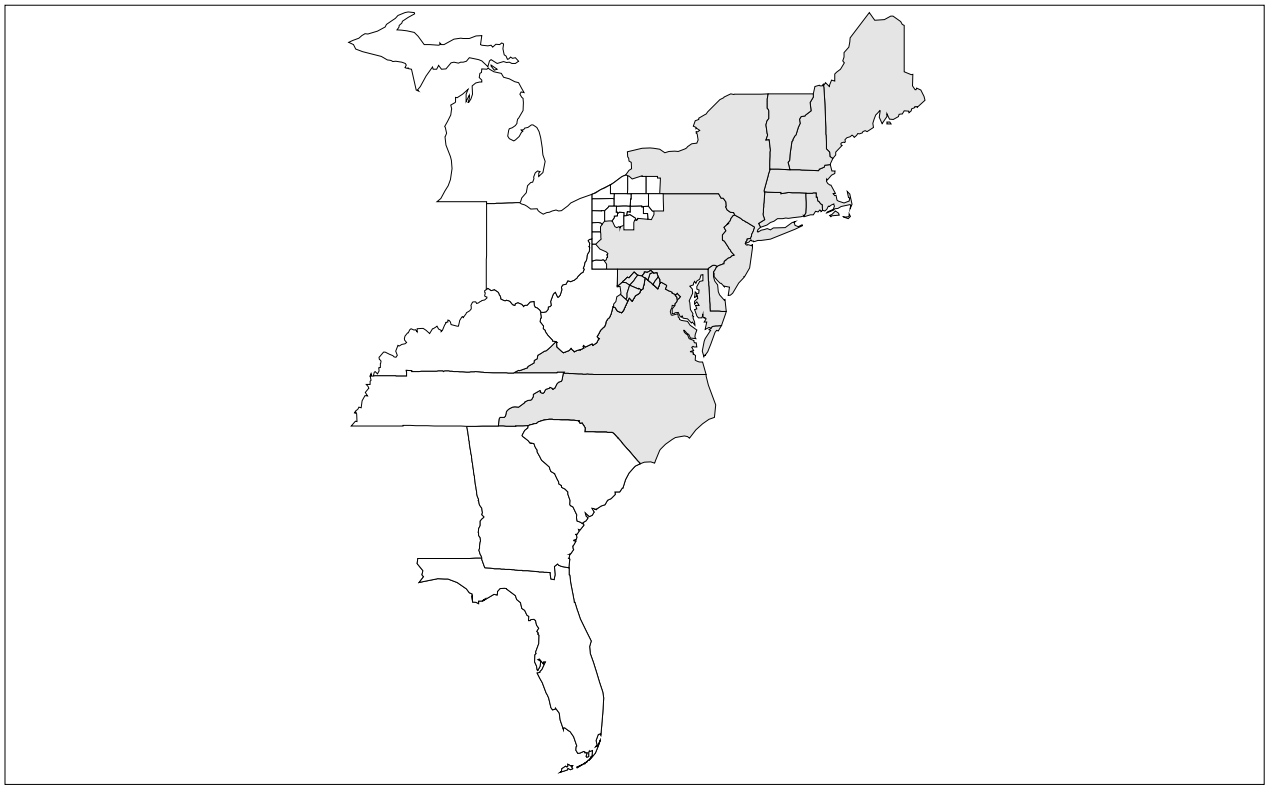
[119] See chapter V of the RIA for a detailed discussion of the analysis which supports our definition of the Northeast/Mid-Atlantic areas where the marker requirement is waived. See section VI of today's preamble and chapter VII of the RIA for a discussion of the costs of the heating oil marker requirements finalized by today's rule.

Jefferson, Clarion, Forest, Venango, Mercer, Crawford, Lawrence, Beaver, Washington, and Greene), and the eight eastern-most counties in West Virginia (namely: Jefferson, Berkely, Morgan, Hampshire, Mineral, Hardy, Grant, and Pendleton). The Northeast/Mid-Atlantic Area is illustrated in the following figure:

Figure IV.D-1. – Northeast/Mid-Atlantic Area Where Marker is not Required



As discussed in section IV.D.2 below, the marker requirement for 500 ppm sulfur LM diesel fuel that will be effective outside of this Northeast/Mid-Atlantic area and Alaska from June 1, 2010, through May 31, 2012, was not a significant factor in our evaluation how to define the boundary of the Northeast/Mid-Atlantic area. We expect that locomotive and marine diesel fuel subject to the marker requirements will primarily be distributed via segregated pathways from a limited number of refineries. Therefore, a significant number of terminals will not need to handle LM diesel fuel that is subject to the marker requirement. Thus, the potential cost of installing injection equipment to add the marker to 500 ppm sulfur LM diesel fuel which is subject to the marker requirement will be limited to only a few refineries and terminals (i.e. approximately 15, see section VI.A of today's preamble).

In all areas of the country other than the Northeast/Mid-Atlantic area shown in figure IV.D-1 (and Alaska as discussed below), heating oil, and high sulfur NRLM diesel fuel will be designated at the refinery or importer and tracked through the distribution system to the terminal. From June 1, 2010, through May 31, 2012, 500 ppm sulfur LM diesel fuel and 500 ppm nonroad diesel fuel must also be designated at the refinery or importer and tracked through the distribution system to the terminal outside of the Northeast/Mid-Atlantic area and Alaska. The specified fuel marker (see section V.E of this preamble) must be added to heating oil distributed from all terminals located outside of the Northeast/Mid-Atlantic area defined above and Alaska. The same fuel marker must also be added to 500 ppm sulfur LM diesel fuel produced at a refinery or imported that is distributed from terminals located outside of the Northeast/Mid-Atlantic area and Alaska from June 1, 2010, through May 31, 2012. This includes all heating oil and the subject 500 ppm sulfur LM diesel fuel distributed from terminals outside of the Northeast/Mid-Atlantic area regardless of whether the fuel is delivered to a retailer, wholesale purchaser-consumer, or end-user located inside or outside of the Northeast/Mid-Atlantic area.

Terminals inside the Northeast/Mid-Atlantic area are exempted from the fuel marker requirements in today's rule, but only for the volume of heating oil and 500 ppm sulfur LM diesel fuel subject to the marker requirements that is used by wholesale-purchaser-consumers and end-users that are located inside the Northeast/Mid-Atlantic area. Any heating oil and subject 500 ppm sulfur LM diesel fuel distributed from terminals inside the Northeast/Mid-Atlantic area to a retailer, wholesale-purchaser-consumer, or end-user that is located outside of the Northeast/Mid-Atlantic area must be marked.

Terminal operators do not often distribute fuel to retailers, wholesale-purchaser-consumers, and end-users directly. This task is frequently accomplished by "jobbers" who pick up large tank truck loads of fuel from the terminal for delivery to their retailer and wholesale-purchaser-consumer customers, "heating oil dealers" who pick up fuel from a terminal using a smaller capacity tank truck (often referred to as a tank wagon) for direct delivery to heating oil users, and by bulk plant operators. Bulk plant operators pick up fuel from terminals as described above. However, since they maintain their own bulk fuel storage facilities, they have the choice of storing the fuel at their facility prior to eventual delivery to their customers. Under the provisions of today's rule, as long as a bulk plant only receives heating oil to which the marker

has already been added, it does not have to register, keep records, or report. However, if it chooses to receive any unmarked heating oil, then it will be treated the same as a large terminal under the provisions of today's final rule. We do not expect that bulk plants will handle LM diesel fuel to a significant degree. For bulk plant operators that might handle LM diesel fuel, today's rule provides that as long as a bulk plant does not receive any 500 ppm sulfur LM diesel fuel which is required to be marked under today's rule, but which has not yet been marked, it does not have to register, keep records, or report. However, if it chooses to receive any unmarked 500 ppm sulfur LM diesel fuel which is subject to the marker requirements under today's rule, then it will be treated the same as a large terminal under the provisions of today's final rule.

Any party that transports bulk quantities of heating oil solely to the Northeast/Mid-Atlantic area or within this area is not subject to the designate and track requirements for heating oil described below. Similarly, any party that transports bulk quantities of 500 ppm sulfur LM diesel fuel solely to the Northeast/Mid-Atlantic area or within this area is not subject to the designate and track requirements for LM diesel fuel. However, any high sulfur fuel distributed from inside the Northeast/Mid-Atlantic area to outside of the Northeast/Mid-Atlantic area must be designated as heating oil by the party responsible for the transfer and must be marked. Likewise, any 500 ppm sulfur LM diesel fuel distributed from inside the Northeast/Mid-Atlantic area from June 1, 2010, through May 31, 2012 must be designated as 500 ppm sulfur LM diesel fuel by the party responsible for the transfer and must be marked.

Entities who are required to inject marker into heating oil must maintain records of the volume of marker used in heating oil, and the volume of heating oil distributed over the compliance period. Entities that are required to inject marker into 500 ppm sulfur LM diesel fuel must maintain records of the volume of marker used in 500 ppm sulfur LM diesel fuel, and the volume of 500 ppm sulfur LM diesel that is required to be marked which is distributed over the compliance period. These records must demonstrate that the prescribed marker concentration was present in the heating oil and the 500 ppm sulfur LM diesel fuel subject to the marker requirement that they discharged.

iii. State of Alaska

Although the fuel marker facilitates the enforcement of the NRLM diesel fuel sulfur standards by distinguishing it from heating oil, as described above, we are not requiring use in Alaska. Unlike the situation in the Northeast and Mid-Atlantic area, however, we are not prohibiting the production of high sulfur NRLM diesel fuel after 2007, and 500 ppm nonroad diesel fuel from after 2010 by small refiners in Alaska. While such a prohibition in the Northeast/Mid-Atlantic area does not impact small refiners, flexibility for small refiners is expected to be important in Alaska. Thus, we need to preserve the flexibility for high sulfur NRLM diesel fuel in Alaska for small refiners along with eliminating the marker. The program must therefore provide another means of enforcing the NRLM diesel fuel sulfur standards without eliminating a small refiner's ability to produce and distribute high sulfur NRLM diesel fuel.

Under today's program we are finalizing a provision that will allow flexibility for small refiners to delay compliance with the NRLM diesel fuel sulfur standards as discussed in section IV.B. Small refiners in Alaska may avail themselves of this option provided that the refiner first obtains approval from the administrator for a compliance plan. The plan must at a minimum show the following information:
1) How they will segregate its fuel through to end-users;
2) How they will segregate its fuels from other grades and other refiners' fuels; and
3) All end-users to whom the fuel is sold as well as the fuel volumes.

End-users who receive the fuel must retain records of all fuel shipments to demonstrate that no heating oil was used in NRLM diesel equipment and that no 500 ppm sulfur LM diesel was used in nonroad equipment. In order to limit the potential sources of fuel not meeting the sulfur standard, constrain the number of end-users who may legitimately have higher sulfur fuel in their NRLM diesel equipment, and thus maintain the overall program's enforceability, we are not finalizing the other provisions that allow for higher sulfur fuel to be produced and/or distributed in Alaska (i.e., credit, transmix processor, or downstream distribution system provisions). In this regard, Alaska is treated in the same manner as the Northeast/Mid-Atlantic area.

c. Updating the Highway Program's Anti-Downgrade Requirements

Under the highway diesel fuel program, each entity in the distribution system may downgrade a maximum of 20 percent of the 15 ppm sulfur highway diesel fuel it receives to 500 ppm sulfur highway diesel fuel. However, there was no limit on the volume of 15 ppm sulfur highway diesel fuel that could be downgraded to NRLM diesel fuel. Prior to today's rule, this was appropriate because the sulfur content of NRLM diesel fuel was uncontrolled, and hence once 15 ppm sulfur highway diesel fuel was downgraded to NRLM diesel fuel such fuel could not be used in the 500 ppm sulfur highway diesel market. The implementation of today's 500 ppm sulfur standard for NRLM diesel fuel, however, means that 15 ppm sulfur highway fuel downgraded to 500 ppm sulfur NRLM diesel fuel potentially could be shifted into the highway market. This could undermine the benefits of the highway program for the reasons described previously. To prevent this situation, we proposed that the anti-downgrading requirements under the highway diesel program would also apply to the downgrading 15 ppm sulfur highway diesel fuel to 500 ppm sulfur NRLM diesel fuel. We received comments from refiners and fuel distributors that such a limitation would restrict their ability to supply the NRLM diesel market, particularly in areas where refiners plan to supply only 15 ppm sulfur diesel fuel for both the highway and NRLM markets.

Putting in place the designate and track provisions allows 500 ppm sulfur highway and 500 ppm sulfur NRLM diesel fuel to be tracked separately. This enables the anti-downgrading requirements to only apply to the downgrading of 15 ppm sulfur highway diesel fuel to 500 ppm sulfur highway fuel as originally required in the 2007 highway final rule. In the context of the designate and track requirements in today's rule, the highway program's anti-downgrading provisions are clarified as described below. Similar to the approach described above regarding the

prevention of the use of 500 ppm sulfur NRLM diesel fuel in the highway market, each custodian of 15 ppm sulfur No. 2 highway diesel fuel must maintain records that demonstrate their compliance with the highway program's anti-downgrade requirements. The anti-downgrading requirements do not apply to 15 ppm sulfur No 1, diesel fuel. Such fuel will be manufactured for wintertime blending to improve diesel cold flow properties. In a number of areas we expect that 15 ppm sulfur No. 1 fuel will be the only No.1 fuel available for winterizing highway and NRLM diesel fuel, and heating oil. Therefore, applying the anti-downgrading requirements to 15 ppm sulfur No. 1 fuel would be unnecessary to maintain the availability of 15 ppm sulfur highway diesel fuel, and would interfere with its intended use in the range of No. 2 fuels.

From October 1, 2006, through May 31, 2010, all fuel distributors downstream of the refiner or import facility must satisfy one of four criteria as outlined in 40 CFR 80.598 of today's regulation to demonstrate compliance with the highway program's anti-downgrading requirements. These criteria are based on the designate and track system for different grades of fuel through the distribution system. The first criteria is the simplest and most straightforward, with the least record keeping burden. It merely tracks a facility's No. 2 15 ppm sulfur highway diesel volume receipts and deliveries and requires the deliveries to be at least 80 percent of the receipts. Since the anti-downgrading provisions were implemented to protect against intentional downgrading and not to limit downgrading that would occur in the normal distribution of 15 ppm sulfur fuel, we anticipate that most facilities will be able to easily meet this simple criteria.

The second criteria tracks a facility's receipts and distribution of both No. 2 15 ppm sulfur fuel and No.2 500 ppm sulfur highway diesel fuel, and limits deliveries of No. 2 500 ppm sulfur highway diesel fuel to no more than what was received plus 20 percent of the No. 2 15 ppm sulfur highway diesel fuel volume received. This allows more flexibility than the first criteria by not constraining downgrades to NRLM diesel fuel or heating oil, but does so by requiring tracking and records of volumes of No. 2 15 ppm sulfur highway diesel fuel received and the products to which it is downgraded.

The third and fourth criteria provide even more flexibility, especially for wintertime blending of No. 1 15 ppm sulfur highway diesel fuel, and also for any temporary shifts that might occur between NRLM diesel fuel and highway diesel fuel markets from 2007-2010. However, a facility will have to meet more extensive criteria to demonstrate compliance.

Today's final rule does not change any other aspects of the anti-downgrading provisions finalized in the 2007 highway diesel final rule, such as the provisions unique to fuel retailers.

2. Requirements During the Second Step of Today's Sulfur Control Program

Beginning June 1, 2010, all NR diesel fuel and beginning June 1, 2012 all LM diesel fuel produced or imported must meet a 15 ppm sulfur standard except for fuel manufactured under the credit and small refiner provisions in today's rule. This credit and small refiner diesel fuel must meet a 500 ppm sulfur level. From June 1, 2010 to June 1, 2012, all LM diesel fuel must meet a

500 ppm sulfur standard. Today's rule also allows 500 ppm sulfur diesel fuel generated in the pipeline distribution system to be used in NRLM equipment through May 31, 2014[120] and in locomotive and marine equipment thereafter. After May 31, 2014, the credit and small refiner provisions expire.

We proposed that once refiners were no longer able to produce 500 ppm sulfur diesel fuel for use in nonroad engines and such fuel had a few months to work its way through the distribution system, that 500 ppm sulfur diesel fuel could no longer be used in nonroad equipment. Today's rule adopts this proposed prohibition. Although today's rule extends the 15 ppm sulfur nonroad diesel standard to locomotive and marine diesel fuel, we have elected not to extend the prohibition against the use of 500 ppm sulfur diesel fuel in locomotive and marine equipment after refiners and importers are no longer allowed to produce/import such fuel. Diesel fuel with a maximum sulfur concentration of 500 ppm that is generated in the pipeline distribution system can continue to be used in locomotive and marine equipment after June 1, 2014, as discussed in section IV.A above.

Providing for the continued use of 500 ppm sulfur diesel fuel in NRLM equipment through May 31, 2014, means that without adequate controls similar to those under the first step of today's program, a refiner could manufacture 500 ppm sulfur diesel fuel ostensibly for use as heating oil which could actually be sold downstream into the NRLM market through May 31, 2014. Similarly, the continued use of 500 ppm fuel in locomotive and marine engines after May 31, 2014, means that without adequate controls, a refiner could continue to manufacture 500 ppm sulfur diesel fuel ostensibly for use as heating oil which could actually be sold downstream into the locomotive and marine market indefinitely. To prevent this possibility, we have elected to continue the designate and track and marker requirements for heating oil applicable under the first step of today's program indefinitely with some simplifications. It is a significantly smaller program during the second step, since only heating oil needs to be tracked, and we expect that by then very little heating oil will be produced for sale outside of the Northeast/Mid-Atlantic area. Consistent with the approach taken during the first step of today's program, these designate and track provisions would not be applicable in the Northeast/Mid-Atlantic area or Alaska, since the flexibility to sell greater than 15 ppm sulfur diesel fuel into the NRLM market there does not exist under this final rule.[121] Any diesel fuel with a sulfur content greater than 500 ppm beginning June 1, 2007, any NR diesel fuel with greater than 15 ppm sulfur beginning June 1, 2010, and any LM diesel fuel with greater than 15 ppm sulfur beginning June 1, 2012 in the Northeast/Mid-Atlantic area can only be sold as heating oil, and if shipped outside of the Northeast/Mid-Atlantic area must be marked as heating oil.

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[120] The use of 500 ppm fuel in nonroad equipment is restricted to 2011 model year and earlier equipment.

[121] Unless, in the case of Alaska, the refiner segregates its fuel through to the end user as discussed in section IV.D.1.b.ii.

While today's rule does not contain an end date for the downstream distribution of 500 ppm sulfur locomotive and marine fuel, we will review the appropriateness of allowing this flexibility based on experience gained from implementation of the 15 ppm sulfur NRLM diesel fuel standard. We expect to conduct such an evaluation in 2011. Were we to discontinue the downstream provision for downgraded fuel, we would also evaluate discontinuing the designate and track and marker requirements for heating oil, as is the case now for the Northeast/Mid-Atlantic area.

Providing for the continued production and import of 500 ppm sulfur LM diesel fuel from June 1, 2010 to June 1, 2012 means that without adequate controls similar to those under the first step of today's program, a refiner could manufacture 500 ppm sulfur diesel fuel ostensibly for use as LM diesel fuel which could actually be sold downstream into the NR market. To prevent this possibility, we have adopted designate and track and marker requirements similar to those applicable to heating oil under the first step of today's program. For these two years, 500 ppm sulfur NR and LM diesel fuel would be tracked, and the 500 ppm sulfur LM fuel would be marked in the same manner as heating oil. The same provisions that apply to marking of heating oil, such as the Northeast/Mid-Atlantic area, would also apply to the marking of 500 ppm sulfur LM fuel. The tracking and marking provisions would not apply to any 15 ppm sulfur LM diesel fuel.

3. Summary of the Designate and Track Requirements

The designate and track program requires refiners and importers to designate the volumes of diesel fuel they produce and/or import. Refiners/importers will identify whether their diesel fuel is highway or NRLM and the applicable sulfur level. They may then mix and fungibly ship highway and NRLM diesel fuels that meet the same sulfur specification without dyeing their NRLM diesel fuel at the refinery gate. The volume designations will follow the fuel through the distribution system with limits placed on the ability of downstream parties to change the designation. These limits are designed to restrict the inappropriate sale of 500 ppm sulfur NRLM diesel fuel into the highway market; from 2007 to 2010, the inappropriate sale of 500 ppm sulfur LM diesel fuel into the 500 ppm sulfur NR market from 2010 to 2012; and the inappropriate sale of heating oil into the NRLM market. The designate and track approach includes record keeping and reporting requirements for all parties in the fuel distribution system, associated with tracking designated fuel volumes through each custodian in the distribution chain until the fuel exits the terminal. The program also includes enforcement and compliance assurance provisions to enable the Agency to rapidly and accurately review for discrepancies the large volume of data collected on fuel volume hand-offs.

a. Registration

Each entity in the fuel distribution system, up through and including the point where fuel is loaded onto trucks for distribution to retailers or wholesale purchaser-consumers, must register each of its facilities with EPA no later than December 31, 2005, or six months prior to

commencement of producing, importing, generating, or distributing any designated diesel fuel.[122] A facility is defined as the physical location(s) where a party has custody of designated fuel, from when it was produced, imported, or received from one party to when it is delivered to another party. The definition also include mobile components, such as the vessels in a barge facility. Examples of facilities include refineries, import terminals, pipelines, terminals, bulk plants, and barge systems. Where the same entity owns and operates a series of locations in the distribution system (e.g., refiner to pipeline to terminal), it may choose to register them as a single aggregated facility, provided the entity maintains custody of the fuel throughout the facility. However, if the aggregated facility includes a refinery, then it may not receive any diesel fuel from another entity at any place within the aggregated facility. Under this approach, a pipeline could be treated as one facility from the point where it receives fuel to the point where it either delivers it to a terminal, or into a tank truck after passing through their terminal. The choice made by the entity to treat these places as a single facility or separate facilities may not change during any applicable compliance period. These same definitions for facility will apply for both the designate and track provisions, as well as the anti-downgrading provisions of the highway rule. Therefore, if a proprietary system chooses to aggregate into one facility for purposes of the designate and track provisions, it will also be treated as one facility for determining compliance with the 20 percent anti-downgrading limit of the highway rule. EPA will provide a unique registration number to each custodial facility of designated fuels. In addition, EPA intends to work with industry subsequent to this final rule to provide guidance regarding facility boundary and aggregation decisions that will address the many unique situations.

The designation provisions described below require refiners and importers to designate all distillates they produce or import consistent with the production and end-use requirements in today's rule. These designations serve as the foundation upon which the fuel distributors are able to properly track, designate, redesignate, and label the fuel they receive.

b. Designation by Refiners and Importers

i. Designation of 500 ppm and 15 ppm Sulfur Diesel Fuel

From June 1, 2006, through May 31, 2010, any refiner[123] or importer that produces or imports 15 ppm sulfur diesel fuel, and/or 500 ppm sulfur diesel fuel must designate all batches of such fuel as one of the following. The purpose of this designation requirement is to ensure that

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[122] This requirement also applies to parties inside of the Northeast/Mid-Atlantic area who handle heating oil.

[123] Transmix operators that produce diesel fuel from transmix and terminal operators that produce from segregated interface will be treated as a refiner for the purposes of compliance with these requirements.

500 ppm sulfur NRLM diesel fuel is not shifted into the highway market, and to evaluate compliance with the highway program's anti-downgrade requirements.

- 15 ppm sulfur No. 2 highway diesel fuel;
- 15 ppm sulfur No. 1 highway diesel fuel;
- 500 ppm sulfur No. 2 highway diesel fuel;
- 500 ppm sulfur No. 1 highway diesel fuel;
- 500 ppm sulfur No. 2 NRLM diesel fuel;
- 500 ppm sulfur No. 1 NRLM diesel fuel;
- 500 ppm sulfur jet fuel; or
- 500 ppm sulfur kerosene.

The start date for these requirements coincides with the start date for the early credit program under today's final rule, and the start date for the highway diesel program for the purposes of anti-downgrading. The end date for these requirements coincides with the end date for the highway program's Temporary Compliance Option and today's NRLM diesel fuel early credit program.

Any batch of 15 ppm or 500 ppm No. 1 diesel fuel which is also suitable for use as kerosene or jet fuel (referred to as dual-purpose kerosene) may be considered kerosene or jet fuel and need not be designated as highway or NRLM diesel fuel, even if it may later be blended into highway or NRLM diesel fuel downstream of the refinery to improve the cold-flow properties of the fuel. Upon such blending, the kerosene or jet fuel takes on the designation of the diesel fuel into which it was blended. We expect refiners and importers will elect to designate all of their 15 ppm sulfur No. 1 diesel fuel as highway fuel, since this will aid in their compliance with the highway program's 80/20 highway fuel production requirement. Designation as highway diesel fuel by the refiner will also help avoid downstream blending from causing a violation by the downstream party under the tracking and compliance calculations finalized today. We also expect that refiners and importers will elect to designate their 500 ppm sulfur No. 1 fuel as kerosene or jet fuel since this will be the predominant use for such fuel, and designating it as highway would hinder their compliance with the 80/20 highway requirements. As with 15 ppm sulfur kerosene or jet fuel, downstream parties would later redesignate it as highway or NRLM diesel fuel if blended in or used for these purposes. Any 500 ppm sulfur diesel fuel containing visible evidence of red dye must be designated as NRLM diesel fuel or heating oil unless it is tax exempt highway diesel fuel (e.g., fuel for use in school buses or certain municipal fleets).

The reported volumes of designated fuels must be the volumes delivered to the first downstream party. This is typically a pipeline facility, a marine barge/tanker loading dock that accepts product from a refiner/importer, or the refiner's/importer's truck loading rack. This is consistent with normal business practices. Refiners, importers, and transmix processors are not required to add red dye to NRLM diesel fuel unless the fuel is distributed over their truck loading rack such that the IRS requires the addition of red dye for the assessment of taxes.

Fuel designated by a refiner or importer as highway diesel fuel must comply with the highway program's 80/20 requirement for 15 ppm/500 ppm sulfur highway diesel fuel. The volume of fuel designated as NRLM early credit fuel must be consistent with the credit provisions in today's rule. Since highway diesel fuel volumes are determined at the point of delivery from the refiner/importer to another party, the anti-downgrade requirements do not apply to refiners and importers. Under the highway diesel fuel program, refiners that are required to produce 100 percent of their highway diesel fuel to a 15 ppm sulfur standard are provided with an allowance to deliver a small percentage of 500 ppm sulfur diesel fuel to the pipeline (e.g., small refiners and GPA refiners who exercise an option under the 2007 highway rule to delay compliance with gasoline sulfur standards). This allowance is provided because a small volume of "line-wash" is typically generated in the feed line from the refiner's facility to the pipeline. This line-wash will often be suitable for use as 500 ppm sulfur highway diesel fuel. Under the provisions of the highway rule this line-wash could have been excluded from compliance with the 15 ppm standard if the refiner accounted for their production volume prior to shipment. However, in this rule, all volume-related requirements are keyed to the volume actually delivered. As a result of this change in the point of fuel volume measurement (delivered versus produced), we are amending the highway diesel fuel program requirements such that refiner who was previously required to produce 100 percent of its highway diesel fuel to the 15 ppm sulfur standard may now produce 95 percent to the 15 ppm sulfur standard (in order to avail itself of the extended gasoline sulfur interim standards).

ii. Designation of High Sulfur NRLM Diesel Fuel, Heating Oil, and Jet Fuel/Kerosene

From June 1, 2007 through May 31, 2010, any refiner, or importer not located in the Northeast/Mid-Atlantic area or Alaska, that produces or imports unmarked high sulfur distillate fuel must designate all batches of such fuel as one of the following: heating oil, high sulfur NRLM diesel fuel, or jet fuel/kerosene. Any heating oil distributed from a refiner's or importer's rack not located in the Northeast/Mid-Atlantic area or Alaska must contain the designated marker and red dye. Any heating oil distributed from a refiner/importer rack inside of the Northeast/Mid-Atlantic area or Alaska is exempted from the marker requirement except any heating oil that is delivered outside the Northeast/Mid-Atlantic area must be marked.

As discussed previously, 500 ppm sulfur diesel fuel may be used in NRLM equipment through May 31, 2014 and in locomotive and marine equipment thereafter. Therefore, designate and track provisions for heating oil will be needed to ensure that heating oil is not shifted into the NRLM market from June 1, 2007 through May 31, 2014, and to the locomotive and marine market thereafter. Consequently, from June 1, 2010 through May 31, 2014, refiners and importers must continue to designate any heating oil they produce as such as well as any 500 ppm sulfur NRLM diesel fuel produced under the small refiner, transmix/segregated interface, and credit provisions.

Beginning June 1, 2014, refiners and importers may no longer produce or import 500 ppm sulfur diesel fuel for use in NRLM equipment. Therefore, beginning June 1, 2014, all diesel fuel with a sulfur level greater than 15 ppm must be designated as heating oil, jet fuel, or kerosene. The one exception to this is transmix processors and terminals acting as refiners which will be permitted to produce 500 ppm sulfur diesel fuel for use in locomotive and marine equipment from transmix and segregated interface.

iii. Designation of 500 ppm NR and 500 ppm LM Sulfur Diesel Fuel

From June 1, 2010, through May 31, 2012, any refiner or importer that produces or imports 500 ppm sulfur NR diesel fuel (small refiner and credit) and/or 500 ppm sulfur LM diesel fuel must designate all batches of such fuel. The purpose of this designation requirement is to ensure that 500 ppm sulfur LM diesel fuel is not shifted into the NR market. Any 500 ppm sulfur LM diesel fuel distributed from a refiner's or importer's rack not located in the Northeast/Mid-Atlantic area or Alaska must contain the designated marker and red dye, along with heating oil. Any 500 ppm sulfur LM diesel fuel distributed from a refiner/importer rack inside of the Northeast/Mid-Atlantic area or Alaska is exempted from the marker requirement except any 500 ppm sulfur LM fuel that is delivered outside the Northeast/Mid-Atlantic area must be marked.

c. Designation and Tracking Requirements Downstream of the Refinery or Importer

The result of the refiner/importer designation provisions is that all of the diesel fuel received by distributors will be clearly and accurately designated. The distributors are then subject to their own designation and tracking requirements. The downstream provisions are designed to ensure that certain fuel shifts do not occur, such as the inappropriate shifting of 500 ppm sulfur NRLM diesel fuel to the highway market, the inappropriate shifting of 500 ppm sulfur LM diesel fuel into the nonroad market, the inappropriate downgrading of 15 ppm sulfur to 500 ppm sulfur highway diesel fuel, and the inappropriate shifting of heating oil to the NRLM market. The downstream provisions are designed to ensure these results in a readily enforceable manner while maximizing downstream flexibility to address changing market conditions.

In general, each time custody of designated fuel is transferred from one facility to another facility, the transferor must designate the fuel and record it's volume. The party who receives custody must record the same information, to ensure that each party relies on the same designation and volume for its own compliance purposes. This process occurs each time custody of diesel fuel is transferred. Each distributor may redesignate fuel while in its custody or when it is delivered, subject to certain basic requirements. First, any re-designation must be accurate. For example, 500 ppm sulfur NRLM diesel fuel can not be redesignated as 15 ppm unless it in fact meets the 15 ppm standard. The sulfur standard applicable to downstream fuel is based on the fuel's designation. Second, there are limits on the fuel volumes that can be redesignated, calculated as a volume balance over a specified compliance period. Specifically, the volumes of 15 ppm and 500 ppm sulfur highway received must be compared to the volumes of these fuels delivered, to ensure that the amount of 15 ppm sulfur highway diesel fuel that is downgraded to

500 ppm sulfur highway diesel fuel complies with the highway program's anti-downgrading requirements. The volumes of 500 ppm sulfur highway and NRLM diesel fuel that a distributor receives must also be compared to the volumes of 500 ppm sulfur highway and NRLM diesel fuel delivered, to ensure that NRLM diesel fuel was not inappropriately transferred to the highway market. The volumes of 500 ppm sulfur NR and LM diesel fuel received must be compared to the volumes of 500 ppm sulfur NR and LM diesel fuel delivered, to ensure that the 500 ppm sulfur LM fuel was not inappropriately transferred to the NR market. In addition, the volumes of heating oil received must be compared to the volumes distributed to ensure it was not inappropriately transferred to the NRLM market. These volume balances are calculated over a compliance period, providing distributor's the day to day flexibility to redesignate fuel based on market conditions, as long as the required volume balance is achieved over the compliance period. Finally, once NRLM diesel fuel is dyed, 500 ppm sulfur LM diesel fuel is marked (2010-2012), or heating oil is marked, the dye and marker may be used to ensure the fuels are not inappropriately shifted to other markets, and the designation, tracking and volume balance requirements are no longer needed; just the PTD, labeling, and record keeping provisions typical of our other fuel regulations (e.g., highway diesel) apply.

In large part, the designate and track provisions are structured to be compatible with the normal business practices currently used by the industry to record and reconcile volume transactions between parties. As such, EPA expects that these downstream provisions can be implemented in a fairly straightforward manner.

i. Designation and Tracking of 500 ppm and 15 ppm Sulfur Diesel Fuel

From June 1, 2006 through May 31, 2010, facilities downstream of the refiner or importer must designate and maintain records of all volumes of fuel designated as 15 ppm sulfur highway diesel fuel, 500 ppm sulfur highway diesel fuel, or 500 ppm sulfur NRLM diesel fuel that they receive and deliver. In many cases, we expect that downstream facilities will not change the designation of 500 ppm sulfur diesel fuel from NRLM diesel fuel to highway while the fuel is in their custody. However, to accommodate fluctuations in the demand for highway-designated versus NRLM-designated 500 ppm sulfur fuel, today's rule allows terminals and other distributors to change the designation of 500 ppm sulfur fuel from NRLM diesel fuel to highway diesel fuel on a daily basis, as long as the required volume balance is achieved over the compliance period.[124] Terminal operators must ensure that the running balance of total highway-designated fuel that they discharged from the beginning of today's program does not exceed the volume of highway fuel that they received since, and had in their possession at the beginning of today's program (adjusted for changes in inventory). This simple one-sided test allows 15 ppm sulfur highway diesel fuel to flow to 500 ppm sulfur highway diesel fuel (subject to anti-downgrading limits), 500 ppm sulfur NRLM diesel fuel, or heating oil. It also allows 500 ppm sulfur highway diesel fuel to flow to NRLM diesel fuel or heating oil. However, the flow of NRLM diesel fuel to highway diesel fuel

[124] Any party is free to redesignate highway diesel fuel to NRLM diesel fuel or heating oil at any time. The required volume balance does not limit such designations.

must first have been offset by shifts from highway to NRLM diesel fuel. In this way we can have assurance that the 500 ppm sulfur fuel sold for highway purposes was in fact produced pursuant to the 80/20 requirements of the highway rule. Since any 500 ppm sulfur diesel fuel in the possession of parties downstream of the refiner at the beginning of today's program will be considered as highway diesel fuel, each custodian will begin today's program with a positive volumetric account balance regarding their input/output of highway-designated 500 ppm sulfur. Conformity with this requirement will be evaluated by EPA at the end of each quarterly compliance period.

In order to accommodate volumetric fluctuations due to such factors as thermal expansion of the fuel, facilities such as pipelines upstream of the terminal can use the same volumetric balance. However, since these facilities typically do not, and should not change designations, the compliance periods can be annual. In addition, to ensure that there are no significant redesignations, we are also requiring that the volume of highway-designated 500 ppm sulfur diesel fuel that a facility discharges from its custody must be no greater than 102 percent of the volume of such fuel that it received during each annual compliance period. All parties downstream of the refiner, importer, or transmix processor also must demonstrate that over any given compliance period, they did not downgrade more than 20 percent of the 15 ppm highway diesel fuel that they received to 500 ppm sulfur highway diesel fuel.

From June 1, 2006 through May 31, 2010, distributors must maintain records regarding each transfer of a designated fuel into and out of their facility on a batch-by-batch basis. These records must include the EPA registration number of the source or recipient facility, and the volume of each designated fuel transfer. However, for transfers of dyed NRLM and highway diesel fuel on which taxes have been assessed, the recipient or source facility need not be specifically identified. In such cases, records must be kept regarding the total volume of dyed and tax assessed fuel that is received, discharged, and in inventory during each compliance period. After May 31, 2010, unique records for these designate and track provisions are no longer required, but the normal records and PTDs must still be kept regarding compliance with the fuel standards.

ii. Designation and Tracking of High Sulfur NRLM Diesel Fuel and Heating Oil

The requirements regarding the designation and tracking of heating oil and high sulfur or 500 ppm sulfur NRLM diesel fuel parallel those regarding the designation and tracking of 500 ppm sulfur highway and NRLM diesel fuel discussed above. However, the requirements described below pertain only to facilities not in the Northeast/Mid-Atlantic area or Alaska, and to facilities inside of the Northeast/Mid-Atlantic area that transport heating oil outside of the Northeast/Mid-Atlantic area.

From June 1, 2007 through May 31, 2010, facilities downstream of the refiner or importer must designate all high sulfur diesel fuel they distribute as NRLM diesel fuel and all heating oil they distribute as heating oil, and must keep records of all volumes of fuel designated as high

sulfur NRLM diesel fuel or heating oil. In many cases, we expect that downstream facilities will not change the designation of diesel fuel from heating oil to high sulfur NRLM diesel fuel while the fuel is in their custody. However, today's final rule provides the flexibility to make this change in designation provided that volume balance requirements for high sulfur NRLM diesel fuel are met.

The volume balance for heating oil requires that the volumes of high sulfur NRLM diesel fuel and heating oil received must be compared to the volumes of high sulfur NRLM diesel fuel and heating oil delivered over a compliance period. The volume of high sulfur NRLM diesel fuel may not increase by a greater proportion than the volume of heating oil over a compliance period. There are many reasons why the combined pool of high sulfur fuel will increase in volume such as the inevitable downgrades from 15 ppm and 500 ppm when these fuels are shipped by pipeline. The volume balance allows for this to occur while keeping fuel produced as heating oil from being shifted to NRLM diesel fuel. The volume balance calculation allows high sulfur NRLM diesel fuel and heating oil to increase proportionately, satisfying both needs. As discussed previously, high sulfur NRLM diesel fuel and heating oil compliance will be required on a quarterly basis for terminal facilities that add marker/dye (and are more likely to change designations on a day to day basis), while compliance for other entities (e.g., pipelines) will be on an annual basis. Compliance with the volume balance requirement is determined by comparing volumes received and delivered during that compliance period. There is no need to have a running total volume of high sulfur NRLM diesel fuel delivered from the beginning of the program since we do not expect any party will need to redesignate heating oil to high sulfur NRLM diesel fuel, even on a day-to-day basis. Further, we are not providing any tolerance since sufficient flexibility already exists due to the many sources of downgrade to heating oil.

Facilities must maintain records regarding each transfer of heating oil and high sulfur NRLM diesel fuel that they receive and discharge from June 1, 2007 through May 31, 2010 on a batch-by-batch basis[125]. These records must include the EPA registration number of the source or recipient facility, and the volume of each fuel transfer. However, for transfers of marked heating oil, the recipient or source facility need not be specifically identified. In such cases, records must be kept regarding the total volume of marked heating oil that is received, discharged, and in inventory during each compliance period. For transfers of dyed high sulfur NRLM diesel fuel from a truck loading rack, the specific recipients also do not need to be identified. In such cases, records must be kept regarding the total volume of high sulfur NRLM diesel fuel that is received, discharged, and in inventory during each compliance period.

From June 1, 2010 through May 31, 2014, facilities downstream of the refiner or importer must continue to designate heating oil and any 500 ppm sulfur NRLM diesel fuel that they distribute. Beyond June 1 2014, they must designate 500 ppm sulfur LM diesel fuel in addition to heating oil. Designations for heating oil are subject to the volume balance requirements and records must be kept on the designations.

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[125] As discussed in section V, these records must be kept for five years.

Beginning June 1, 2010, the volume balance requirement for heating oil is simply that the volume of heating oil may not decrease. As discussed previously, there are many reasons why the volume could increase. Consequently, if the volume decreases it would mean that heating oil is being shifted to NRLM or locomotive and marine uses, thereby allowing refiners to circumvent the NRLM diesel fuel sulfur standards. Given the likely increase in heating oil volume for other reasons, there should be ample flexibility provided with this one-sided test to account for minor variations due to volume swell/shrinkage related to temperature, meter differences, or other causes, so no additional tolerance or flexibility is necessary.

iii. Designation and Tracking of 500 ppm Sulfur NR and LM Diesel Fuel

The requirements regarding the designation and tracking of 500 ppm sulfur NR and LM diesel fuel parallel those regarding the designation and tracking of 500 ppm sulfur highway and NRLM diesel fuel discussed above. However, the requirements described below pertain only to facilities not in the Northeast/Mid-Atlantic area or Alaska, and to facilities inside of the Northeast/Mid-Atlantic area that transport 500 ppm sulfur NR and LM diesel fuel outside of the Northeast/Mid-Atlantic area.

From June 1, 2010 through May 31, 2012, facilities downstream of the refiner or importer must continue to designate 500 ppm sulfur NR and LM diesel fuel that they distribute, and must keep records of all volumes of fuel designated as these fuels. In many cases, we expect that downstream facilities will not change the designation of diesel fuel from 500 ppm sulfur LM to 500 ppm sulfur NR diesel fuel while the fuel is in their custody. However, today's final rule provides the flexibility to make this change in designation provided that volume balance requirements for 500 ppm sulfur NR diesel fuel are met.

The volume balance for 500 ppm sulfur NR and LM diesel fuel requires that the volumes of 500 ppm sulfur NR and LM diesel fuel received must be compared to the volumes of 500 ppm sulfur NR and LM diesel fuel delivered over a compliance period. The volume of 500 ppm sulfur NR diesel fuel may not increase by a greater proportion than the volume of 500 ppm sulfur LM diesel fuel over a compliance period. The combined pool of 500 ppm sulfur diesel fuel may increase in volume such as the inevitable downgrades from 15 ppm and 500 ppm sulfur diesel fuel when these fuels are shipped by pipeline. The volume balance allows for this to occur while keeping fuel produced as 500 ppm sulfur LM diesel fuel from being shifted to NR fuel. The volume balance calculation allows 500 ppm sulfur NR and LM diesel fuel to increase proportionately, satisfying both needs. 500 ppm sulfur NR and LM diesel fuel compliance will be required on an annual basis, for terminal facilities as well as other entities. Compliance with the volume balance requirement is determined by comparing volumes received and delivered during that compliance period.

Facilities must maintain records regarding each transfer of 500 ppm sulfur NR and LM diesel fuel that they receive and discharge from June 1, 2010 through May 31, 2012 on a batch-by-

batch basis. These records must include the EPA registration number of the source or recipient facility, and the volume of each fuel transfer. However, for transfers of marked 500 ppm sulfur LM diesel fuel, the recipient or source facility need not be specifically identified. In such cases, records must be kept regarding the total volume of marked 500 ppm sulfur LM diesel fuel that is received, discharged, and in inventory during each compliance period. For transfers of dyed 500 ppm sulfur NR diesel fuel from a truck loading rack, the specific recipients also do not need to be identified. In such cases, records must be kept regarding the total volume of 500 ppm sulfur NR diesel fuel that is received, discharged, and in inventory during each compliance period.

EPA plans to work closely with members of the diesel fuel refining and distribution industry, to provide clear and comprehensive guidance on what is expected of the various parties under the designate and track and volume balance provisions adopted in this rule. EPA invites suggestions from these parties on the most useful ways to provide such guidance.

d. Reporting Requirements

i. Compliance and Reporting Periods

We believe that any regulatory program should promote compliance and deter non-compliance. Today's program includes compliance and reporting provisions to deter noncompliance and to detect and correct instances of noncompliance in a timely fashion. Under today's program entities must submit to the Agency compliance reports containing information on the diesel fuel volumes they handle, separately by fuel designation category. Compliance with these volume designation and tracking requirements will be determined on an annual basis for refiners and pipelines and a quarterly basis for terminals during the first step of today's program. Compliance will be determined on an annual basis for everyone after 2010. To demonstrate compliance, refiners, pipelines, and terminals will be required to submit reports on a quarterly basis during the first step of today’s program and then on an annual basis every year thereafter.

We are requiring the submission of volume reports on a quarterly basis during the first step of today's program for several reasons. First, and most importantly, today’s program allows entities to change the designations of 500 ppm sulfur diesel fuel from NRLM diesel fuel to highway diesel fuel and heating oil to NRLM diesel fuel on a daily basis (provided that they later redesignate the same volume of 500 ppm diesel fuel from highway diesel fuel to NRLM diesel fuel and the same volume of NRLM diesel fuel to heating oil). Second, quarterly reporting coupled with quarterly compliance by terminals will constrain the magnitude of any noncompliance. Finally, during the start up of the designate and track system, there may also be a greater potential for errors in the transmission of records between custodians of designated fuels, in the calculations related to compliance with the volume account balance requirements, and in the materials provided in reports.

Today's program establishes quarterly compliance periods which are based on standard industry practices. Specifically, the quarterly compliance periods finalized in today's rule are as follows:

- 1st quarter: July 1 - September 30;
- 2nd quarter: October 1 - December 31;
- 3rd quarter: January 1 - March 31;
- 4th quarter: April 1 - June 30.

Where the start and end dates of the program do not line up with these dates, the quarters are lengthened or shortened accordingly (e.g., June 1, 2007 - September 30, 2007, and April 1, 2010 - May 31, 2010). Quarterly reports are due two months following the end of the quarterly compliance period (i.e., December 1, March 1, June 1, and September 1). Annual compliance periods begin on July 1 and end June 30 of the following year. Again, certain annual compliance periods were lengthened or shortened to match the significant dates of the program (e.g., June 1, 2007 - June 30, 2008). Annual reports are due by August 31 following the annual compliance period. For the sake of simplifying compliance and record keeping, the compliance periods for the highway final rule have been adjusted to match these.

Reports must be submitted electronically, or in a form which facilitates direct entry into an electronic database. Without reliance on an electronic database and reporting system to cross check and verify reported information, the designate and track provisions would become so cumbersome as to be virtually unenforceable by EPA staff given projected resource availability.

ii. Reporting Requirements During the First Step of Today's Program

During the first step of today's program, from June 1, 2007 through May 31, 2010, entities must report to EPA for each of their facilities regarding the total volume of each of the designated fuels that they receive from, or discharge to, another entity's facility in the fuel distribution system. If a facility is a refiner as well as a distributor (e.g., a blender of biodiesel or blendstocks from unfinished diesel fuel or heating oil or otherwise both accepts previously designated fuel and also produces fuel), it must also report both volumes produced and released to other entities in its capacity as refiner and also report the volumes received and released for each designation like any other terminal or pipeline.

For example, an entity that operates a pipeline may have multiple points where it discharges fuel, and at each of these points it may supply multiple terminals. The pipeline operator must report on the receipt of designated fuel from each party that transfers fuel to it, and on the designated fuel transferred by the pipeline at each discharge point which specifies the fuel transferred, separately for each of its terminal customers. Entities must report for each of their facilities the total volumes of the designated fuels that were either dyed red, marked, or on which taxes were assessed tax while in their custody. Reports regarding these volumes do not need to include details on the recipients of the fuel (but product transfer documents must be kept to facilitate EPA's ability to compare the outgoing transfers and to fuel received).

Entities that handle only dyed NRLM diesel fuel, dyed and marked 500 ppm sulfur LM diesel fuel (2010-2012) and heating oil, or highway diesel fuel on which taxes have been assessed do not need to report to EPA. Information from such entities is not needed for compliance purposes, because there is no chance of violating the prohibitions against the shifting of fuel from one pool to another contained in today's rule without also violating either the requirement that highway diesel fuel contain no red dye, or the requirement that NRLM diesel fuel contain no heating oil marker. Furthermore, consistent with the highway rule, there are no periodic reporting requirements regarding the demonstration of compliance with the highway program's anti-downgrading requirements in today's rule. Maintenance of records should be sufficient for EPA to adequately monitor compliance with these requirements, as insufficient 15 ppm sulfur diesel fuel availability in an area should highlight potential anti-downgrading violations.

Quarterly reports from facilities downstream of the refinery and importer must also include data on the total volume of the designated fuels received, discharged, and in inventory during the quarterly reporting period. Using these data, the reporting party must demonstrate compliance with the volume account balance requirements regarding highway diesel fuel and high sulfur NRLM.

iii. Reporting Requirements During the Second Step of Today's Program

We believe that we may safely dispense with quarterly reporting and compliance evaluations starting June 1, 2010 and instead rely on annual reports. During the second step of today's rule, the designate and track requirements will be focused on preventing the use of heating oil in NRLM equipment, and during 2010-2012 preventing the use of 500 ppm sulfur LM diesel fuel in nonroad equipment. By 2010, all reporting parties in the system will have had experience in complying with the program's designate and track provisions. In addition, the Agency will have had ample experience in administering the system. Consequently, we expect that there will be few errors or omissions in reports and that EPA will have determined how best to detect and remedy instances of noncompliance. We believe an annual reporting period is therefore sufficient and appropriate.

Beginning June 1, 2010, entities that produce, import, or take custody of 500 ppm sulfur NRLM diesel fuel, marked heating oil, or unmarked heating oil outside of the Northeast/Mid-Atlantic area and Alaska, must submit an annual report to EPA that provides summary information regarding the transfer of these fuels.[126] Entities must report for each of their facilities the total volume of each of these fuels that they received from, or discharge to, another entity's facility in the fuel distribution system during each annual compliance period. For batches of heating oil that are delivered marked, the reports do not need to indicate the entities to which the batches were delivered – only the total volume of marked heating oil delivered during each compliance period must be reported. If an entity only receives marked heating oil (i.e., it does not

[126] 500 ppm sulfur NR diesel fuel, and starting June 1, 2012, 500 ppm sulfur NRLM diesel fuel, is not permitted in the Northeast/Mid-Atlantic area and only in the State of Alaska in limited circumstances.

receive any unmarked heating oil), it does not need to report at all. If a facility received marked heating oil in addition to unmarked heating oil, it must report the volume of marked heating oil separately and indicate the facility from which the marked heating oil was received.

Beginning June 1, 2010 to June 1, 2012, entities that produce, import, or take custody of 500 ppm sulfur NR and LM diesel fuel outside of the Northeast/Mid-Atlantic area and Alaska, must submit an annual report to EPA that provides summary information regarding the transfer of these fuels.[127] Entities must report for each of their facilities the total volume of each of these fuels that they received from, or discharge to, another entity's facility in the fuel distribution system during each annual compliance period. For batches of 500 ppm sulfur LM diesel fuel that are delivered marked, the reports do not need to indicate the entities to which the batches were delivered – only the total volume of marked 500 ppm sulfur LM diesel fuel delivered during each compliance period must be reported. If an entity only receives marked 500 ppm sulfur LM diesel fuel (i.e., it does not receive any unmarked 500 ppm sulfur LM diesel fuel), it does not need to report at all. If a facility received marked in addition to unmarked 500 ppm sulfur LM diesel fuel, it must report the volume of marked 500 ppm sulfur LM diesel fuel separately and indicate the facility from which the marked 500 ppm sulfur LM diesel fuel was received.

E. How Are State Diesel Fuel Programs Affected by the Sulfur Diesel Program?

Section 211(c)(4)(A) of the CAA prohibits states and political subdivisions of states from prescribing or attempting to enforce, for purposes of motor vehicle emission control, "any control or prohibition respecting any characteristic or component of a fuel or fuel additive in a motor vehicle or motor vehicle engine," if EPA has prescribed "a control or prohibition applicable to such characteristic or component of the fuel or fuel additive" under section 211(c)(1). This prohibition applies to all states except California, as explained in section 211(c)(4)(B). This express preemption provision in section 211(c)(4)(A) applies only to controls or prohibitions respecting any characteristics or components of fuels or fuel additives for motor vehicles or motor vehicle engines, that is, highway vehicles. It does not apply to controls or prohibitions respecting any characteristics or components of fuels or fuel additives for nonroad engines or nonroad vehicles.[128]

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[127] During this time period, 500 ppm sulfur NR diesel fuel is not permitted in the Northeast/Mid-Atlantic area and only in the State of Alaska in limited circumstances.

[128] See 66 FR 36543, July 12, 2001 (notice proposing approval of Houston SIP revisions). See also letter from Carl Edlund, Director, Multimedia Planning and Permitting Division, U.S. Environmental Protection Agency, Region VI, to Jeffrey Saitas, Executive Director, Texas Natural Resources Conservation Commission, dated September 25, 2000, providing comments on proposed revisions to the Texas State Implementation Plan for the control of ozone, specifically the Post 99 Rate of Progress Plan and Attainment Demonstration for the Houston/Galveston area. This letter noted that preemption under section 211(c)(4) of

Section 211(c)(4)(A) specifically mentions only controls respecting characteristics or components of fuel or fuel additives in a "motor vehicle or motor vehicle engine," adopted "for purposes of motor vehicle emissions control," and the definitions of motor vehicle and nonroad engines and vehicles in CAA section 216 are mutually exclusive. This is in contrast to sections 211(a) and (b), which specifically mention application to fuels or fuel additives used in nonroad engines or nonroad vehicles, and with section 211(c)(1) which refers to fuel used in motor vehicles or engines or nonroad engines or vehicles.

Thus, today's action does not preempt state controls or prohibitions respecting characteristics or components of fuel or fuel additives used in nonroad, locomotive, or marine engines or nonroad, locomotive, or marine vehicles under the provisions of section 211(c)(4)(A). At the same time, a state control that regulates both highway fuel and nonroad fuel is preempted to the extent that the state control respects a characteristic or component of highway fuel regulated by EPA under section 211(c)(1).

A court may consider whether a state control for fuels or fuel additives used in nonroad engines or nonroad vehicles is implicitly preempted under the supremacy clause of the U.S. constitution. Courts have determined that a state law is preempted by federal law where the state requirement actually conflicts with federal law by preventing compliance with the federal requirement, or by standing as an obstacle to accomplishment of congressional objectives. A court could thus consider whether a given state standard for sulfur in nonroad, locomotive or marine diesel fuel is preempted if it places such significant cost and investment burdens on refiners that refiners cannot meet both state and federal requirements in time, or if the state control would otherwise meet the criteria for conflict preemption.

F. Technological Feasibility of the 500 and 15 ppm Sulfur Diesel Fuel Program

This section summarizes our assessment of the feasibility of refining and distributing 500 ppm NRLM diesel fuel starting in 2007 and 15 ppm nonroad diesel fuel in 2010 and locomotive and marine diesel fuel in 2012. Based on this evaluation, we believe it is technologically feasible for refiners and distributors to meet both sulfur standards in the lead time provided with the desulfurization technology available. We begin this section by describing the nonroad, locomotive and marine diesel fuel market and how these fuels differ from current highway diesel fuel. We discuss desulfurization technologies, both conventional and advanced, which are available for complying with the 500 ppm and 15 ppm NRLM standards. We then present what mix of technologies we believe will be used. Next we provide our analysis of the lead time for complying with either standard. Finally, we analyze the feasibility of distributing low sulfur NRLM diesel fuel. We refer the reader to the Final RIA for more details regarding these assessments.

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the CAA did not apply to controls on nonroad diesel fuel.

1. What Is the Nonroad, Locomotive and Marine Diesel Fuel Market Today?

Nonroad, locomotive and marine (NRLM) engines almost exclusively use No. 2 distillate fuel. No. 2 distillate fuel is a class of fuel defined by its boiling range. It boils at a higher average temperature than gasoline, No. 1 distillate, jet fuel and kerosene, and at a lower average temperature than residual fuel (or bunker fuel). ASTM defines three No. 2 distillate fuels: 1) low sulfur No. 2 diesel fuel (No. 2-D); 2) high sulfur No. 2-D; and 3) No. 2 fuel oil.[129] Low sulfur No. 2-D fuel must contain 500 ppm sulfur or less, have a minimum cetane number of 40, and have a minimum cetane index limit of 40 (or a maximum aromatic content of 35 volume percent)(i.e., meet the EPA standard for highway diesel fuel).[130] Both high sulfur No. 2-D and No. 2 fuel oil must contain no more than 5000 ppm sulfur,[131] and currently averages 3000 ppm nationwide. The ASTM specification for high sulfur No. 2-D fuel also includes a minimum cetane number of 40. Practically, since most No. 2 fuel oil meets this minimum cetane number specification, pipelines which ship fuel fungibly need only carry one high sulfur No. 2 distillate fuel which meets both sets of specifications. Currently, nonroad, locomotive and marine engines can be and are fueled with both low and high sulfur No. 2-D fuels. If No. 1 distillate is blended into highway diesel fuel, as is sometimes done to prevent gelling in the winter, the final blend must meet the 500 ppm EPA cap.

No. 1 distillate (e.g., jet fuel and kerosene) meets lower boiling point and viscosity specifications requirements than No. 2 distillate. No. 1 distillate, or any of these other similar boiling distillates, added to No. 2 NRLM distillate becomes NRLM diesel fuel and thus, must meet the applicable specifications for No. 2 distillate.

For the purpose of this rule, we split the No. 2 distillate market into three pieces, according to the sulfur standard which each must meet: 1) highway diesel fuel, 2) NRLM diesel fuel, and heating oil, which is used in both furnaces and boilers, as well as in stationary diesel engines to generate power.

In the NPRM, EPA estimated current production and demand for NRLM fuel from studies conducted by the U.S. Energy Information Administration (EIA). We projected growth in nonroad fuel demand using EPA's NONROAD emission model. We based the growth in locomotive and marine fuel demand from analyses supporting EPA's locomotive and marine engine rulemaking. These future levels of NRLM fuel demand differed from those implicit in our

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[129] "Standard Specification for Diesel Fuel Oils," ASTM D 975-98b and "Standard Specifications for Fuel Oils," ASTM D 396-98.

[130] These ASTM requirements were formed after and are consistent with the EPA regulations for highway diesel fuel.

[131] Some states, particularly those in the Northeast, limit the sulfur content of No. 2 fuel oil to 2000 - 3000 ppm.

projection of the emission reductions associated with the rule, which were based primarily on EPA's NONROAD emission model. We pointed out this inconsistency in the rule and indicated that we would resolve this inconsistency for the final rule.

In their comments on the NPRM, the American Petroleum Institute (API), the Engine Manufacturers Association (EMA) and others highlighted this inconsistency and suggested that EPA resolve it by basing its projection of future NRLM fuel demand using information developed by EIA and not from the NONROAD emission model. API pointed to a lower estimate of nonroad fuel demand developed in a contracted study performed by Baker and O'Brien. A detailed analysis of these comments and additional technical analyses of distillate fuel demand are described in Section 4.6.3.1 of the Summary and Analysis document to this rule. In summary, we decided to continue using the NONROAD emission model to project the emission benefits of this rule. To eliminate the inconsistency in the NPRM, we also use the NONROAD model to determine demand for nonroad fuel and project the economic impacts of this final rule. However, the analyses presented in Section 4.6.3.1 of the Summary and Analysis document to this rule identified uncertainties in the current and future level of nonroad fuel demand. To insure that these uncertainties did not affect the outcome of this rulemaking process, we evaluate the emissions, costs and cost effectiveness of the standards contained in this rule using an alternative estimate of nonroad fuel demand derived from EIA information. This alternative analysis is presented in Appendix 8A of the Final RIA. In addition to use of the NONROAD model to project nonroad fuel demand, we also updated our projections of the production of and demand for highway fuel and heating oil using more recent versions of the same EIA reports used in the NPRM analysis.

In 2001, nationwide outside of California, nonroad diesel fuel comprised about 18 percent of all No. 2 distillate fuel, while locomotive and marine diesel fuel comprised about eight percent of all No. 2 distillate fuel. Diesel fuel consumed by highway vehicles/engines comprised about 56 percent of all No. 2 distillate fuel. Heating oil comprised about 19 percent of No. 2 distillate. Because of limitations in the fuel distribution system and other factors, about 18 percent of all non-highway distillate met the 500 ppm highway diesel fuel cap. Thus, about 64 percent of No. 2 distillate pool met the 500 ppm sulfur cap, not just the 56 percent used in highway vehicles. We project that this spillover of highway fuel to the NRLM diesel fuel market will continue under the highway diesel fuel program. Thus, today's rule will only materially affect about 19 percent of today's distillate market. The remaining 17 percent of No. 2 distillate which is high sulfur heating oil is estimated to remain at higher sulfur levels.

This rule will also affect any No. 1 distillate which is blended into wintertime NRLM fuel. Because gelling can also be prevented through the use of pour point additives, the current and future level of this of No. 1 distillate blending is uncertain. However, the feasibility of desulfurizing and distributing this No. 1 distillate will also be addressed below.

2. What Technology Will Refiners Use to Meet the 500 ppm Sulfur Cap?

Refiners currently hydrotreat most or all of their distillate blendstocks using what is commonly referred to as "conventional" hydrotreating technology to meet the 500 ppm sulfur and cetane limits applicable to highway diesel fuel. This conventional technology has been available and in use for many years. U.S. refiners have nearly ten years of experience with this technology in producing highway diesel fuel. The distillate blendstocks comprising NRLM fuel do not differ substantially from those comprising highway diesel fuel. Thus, the technology to produce 500 ppm sulfur NRLM diesel fuel has clearly been demonstrated and optimized over the last decade. Additionally, this technology continues to evolve primarily through the development of more active catalysts and motivated by the 15 ppm cap applicable to most highway diesel fuel starting in 2006.

Several advanced desulfurization technologies are being developed and are discussed in more detail in the next section. However, the fact that none of these technologies have been demonstrated commercially for a typical catalyst life (i.e., two years) makes it unlikely that they would be selected by many refiners for use in mid-2007. Also, these advanced technologies promise the greatest cost savings in achieving 15 ppm levels, rather than 500 ppm. These advanced technologies can also be combined with a conventional hydrotreater to meet the 15 ppm standard in 2010 and 2012. EPA therefore projects that the 500 ppm sulfur cap NRLM standard will be met using conventional hydrotreating technology. We made this same projection in the NPRM and no comments to the contrary were received.

In some cases, refiners will also need to install or expand several ancillary processes related to sulfur removal (e.g., hydrogen production and purification, sulfur processing, and sour water treatment). These technologies are all commercially demonstrated, as nearly all refineries already have such units.

3. Is the Leadtime Sufficient to Meet the 2007 500 ppm NRLM Sulfur Standard?

After the highway diesel fuel program is implemented, we project that 92 refineries in U.S. will be producing high sulfur distillate fuel. We project that 36 of these refineries will likely produce 500 ppm sulfur NRLM diesel fuel in 2007. Of those 36, 30 will have to build new hydrotreaters while the other 6 are expected to use existing hydrotreaters to produce 500 ppm NRLM diesel fuel.[132] The remaining 56 refineries are projected to continue to produce high sulfur distillate fuel, with 26 of the 56 refineries producing heating oil. The other 30 refineries are owned by small refiners and will likely produce high sulfur NRLM diesel fuel. The 56 refineries

[132] These refiners have said that they will leave the highway market in 2006 in their pre-compliance reports for complying with the Highway Diesel Rule, thus freeing up their existing hydrotreaters to produce 500 ppm NRLM diesel fuel.

continuing to produce high sulfur distillate will not have to add or modify any equipment to continue producing this fuel.

This rule will provide refiners and importers 37 months before they will have to begin producing 500 ppm NRLM diesel fuel on June 1, 2007. Our lead time analysis projects that 27-39 months are typically needed to design and construct a diesel fuel hydrotreater.[133] As discussed below, we believe that 37 months will be sufficient for all refiners of NRLM fuel.

Easing the task is the fact that we project that essentially all refiners will use conventional hydrotreating to comply with the 500 ppm sulfur NRLM diesel fuel cap. This technology has been used extensively for more than 10 years and its capabilities to process a wide range of diesel fuel blendstocks are well understood. Thus, the time necessary to apply this technology for a specific refiner's situation should be relatively short.

Twenty-six out of the 36 refineries projected to produce 500 ppm NRLM diesel fuel in 2007 have indicated that they will produce highway diesel fuel in their highway diesel fuel pre-compliance reports, see RIA section 7.2.1.3.4.1, Table 7.2.1-38 and following discussion for description of these refineries. Thus, roughly 70% of the refiners likely to produce 500 ppm sulfur NRLM diesel fuel in 2007 are already well into their planning for meeting the 15 ppm highway diesel fuel standard, effective June 1, 2006. It is likely that these refiners have already chemically characterized their high sulfur diesel fuel blendstocks, as well as their highway diesel fuel, in assessing how to meet produce 15 ppm fuel. They will also have already assessed the various technologies for producing 15 ppm diesel fuel. This provides an extensive base of information on how to design a hydrotreater to produce 500 ppm NRLM fuel, as well as how to revamp this hydrotreater to produce 15 ppm NRLM diesel fuel in 2010 and 2012. Those refiners only producing high sulfur distillate fuel today will be able to take advantage of the significant experience that technology vendors have obtained in assisting refiners of highway diesel fuel meet the 15 ppm cap in 2006.

We also expect that roughly 20 percent of the 101 refineries in the U.S. and its territories will build a new hydrotreater to produce 15 ppm highway fuel. Those which also produce high sulfur distillate will be able to produce 500 ppm NRLM fuel with their existing highway hydrotreater. In 2007, we conservatively assumed that 20% of the 500 ppm NRLM production from refineries that produce highway and high sulfur distillate could be produced with these existing treaters at no capital costs (existing highway treater capacity available for 500 ppm NRLM production would be higher if based on highway treater capacity). Thus, in 2007 we project that four refineries will be able to use their recently idled highway treater due to building a new highway treater unit for 2006. Furthermore, the highway diesel program pre-compliance reports indicate that another 7 refineries currently producing 500 ppm highway fuel will likely leave the highway fuel market in 2006. We project that 2 of these would use their existing treater

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[133] "Highway Diesel Progress Review," USEPA, EPA420-R-02-016, June 2002. The leadtime analysis in the RIA can be found in section 5.3.

to produce 500 ppm NRLM with no investment costs. Another three of these 101 refineries produce relatively small volumes of high sulfur distillate compared to highway diesel fuel today. We project that they will be able to produce 500 ppm sulfur NRLM fuel from their high sulfur distillate with only minor modification to their existing highway diesel fuel hydrotreater.

Refiners not planning on producing 100 percent highway fuel in 2006 will also need some time to assess which distillate market in which to participate starting in 2007, NRLM or heating oil. While this is a decision which requires some amount of time for analysis, refiners also needed to assess what market they would participate in for the 1993 500 ppm highway diesel fuel sulfur cap. In all, we project that the task of producing 500 ppm sulfur NRLM fuel in 2007 will be less difficult than the task refiners faced with the implementation of the 500 ppm highway diesel fuel cap in 1993. Refiners had just over three years of lead time for complying with the 1993 500 ppm highway diesel fuel cap, as is the case here, and this proved sufficient.

No explicit comments were made by refiners on the lead time needed for complying with the proposed NRLM 500 ppm sulfur standard. However, their comments supported the two step approach, preferring it over a one step, 15 ppm NRLM cap starting in 2008.

4. What Technology Will Refiners Use to Meet the 15 ppm Sulfur Cap?

In the highway diesel rule, we projected that refiners producing 15 ppm fuel in 2006 would utilize extensions of conventional hydrotreating technology. We also projected that refiners first producing 15 ppm fuel in 2010 would use a mix of extensions of conventional and advanced technologies. Based on the refiners' highway pre-compliance reports, it appears that 95% of highway fuel could meet the 15 ppm cap in 2006. We expect that virtually all of this 15 ppm fuel will be produced with conventional hydrotreating. Thus, it appears that conventional hydrotreating will be used to produce the vast majority of 15 ppm highway diesel fuel.

In the nonroad NPRM, we projected that refiners would use advanced desulfurization technologies to produce 80 percent of 15 ppm nonroad diesel fuel in 2010, with the balance using conventional hydrotreating. At the time of the NPRM, all of the advanced technologies appeared to be progressing rapidly. Since the proposal, we have learned that a couple of these technologies, Unipure and S-Zorb, are not going to be commercially demonstrated as soon as expected. However, one refiner is already using Process Dynamics' IsoTherming technology to commercially produce 15 ppm diesel fuel. Thus, we continue to believe that advanced technologies will be used to produce a large percentage of 15 ppm NRLM fuel. However, the number of advanced technologies used may be smaller. Because of the more limited choices, we project that the penetration of advanced technologies will be only 60 percent. The remainder of this section discusses the production of 15 ppm diesel fuel using conventional and advanced technologies.

One approach to produce 15 ppm NRLM fuel would be to revamp the conventional hydrotreater built to produce 500 ppm NRLM fuel in 2007. Knowing that the 500 ppm NRLM

cap will only be in effect for three years for nonroad refiners and five years for locomotive and marine refiners (four years for small refiners), we expect that refiners will design their 500 ppm hydrotreater to allow the production of 15 ppm fuel through the addition of reactor volume or a second hydrotreating stage. Refiners might also shift to a more active catalyst in the existing reactor, as the life of that catalyst might be nearing its end. Equipment to further purify its hydrogen supply could also be added. Producing 15 ppm NRLM fuel via these steps will be feasible as they are essentially the same steps refiners will be using in 2006 to produce 15 ppm highway diesel fuel.

EPA recently reviewed the progress being made by refining technology vendors and refiners in meeting the 2006 highway diesel sulfur cap.[134] All evidence available confirms EPA's projection that conventional hydrotreating will be capable of producing diesel fuel containing less than 10 ppm sulfur. Furthermore, as part of the highway program's reporting requirements, refiners are required to report their progress in complying with the 15 ppm highway diesel fuel standard. In those reports they indicated that they primarily will be applying extensions of conventional hydrotreating. NRLM fuel refiners will have the added advantage of being able to design their 500 ppm hydrotreater with the production of 15 ppm fuel in mind. Additionally, refiners producing 15 ppm NRLM fuel will be able to take advantage of the experience gained from those producing 15 ppm highway fuel.

As mentioned above, several advanced technologies are presently being developed to produce 15 ppm diesel fuel at lower cost. One of these advanced technologies, Process Dynamics IsoTherming, improves the contact between hydrogen, diesel fuel and the desulfurization catalyst. The IsoTherming process dissolves the hydrogen in the liquid fuel phase prior to passing the liquid over the catalyst, eliminating the need for a two- phase (gas and liquid) reactor. The liquid, plug flow reactor design also avoids the poor liquid distribution over the catalyst bed often present in a two- phase reactor design. Process Dynamics projects that their IsoTherming process could reduce the hydrotreater volume required to achieve sub-15 ppm sulfur levels by roughly a factor of two.

Process Dynamics has already built a commercial-sized demonstration unit (5000 barrels per day) at a refinery in New Mexico. They have been operating the unit since September 2002, and demonstrating the capability to meet a 15 ppm cap since the spring of 2003. Thus, refiners will have 4-5 years of operating data on this process before they would have to select a technology to produce 15 ppm nonroad diesel fuel in 2010, and 6-7 years before producing 15 ppm locomotive and marine diesel fuel in 2012. This should be more than sufficient for essentially all refiners to consider this process for 2010 or 2012. Based on information received from Process Dynamics, we estimate that this technology could reduce the cost of meeting the 15 ppm cap for many refiners by about 30 percent. This savings arises from a smaller reactor, less catalyst and avoiding the need for a recycle gas compressor and reactor distributor. Refineries facing poorer

[134] "Highway Diesel Progress Review," USEPA, EPA420-R-02-016, June 2002.

economies of scale, such as small refineries, would particularly benefit from this desulfurization process.

A second process being developed to produce 15 ppm diesel fuel is the Unipure oxidation process. This process oxidizes the sulfur in distillate molecules, facilitating its removal. Unipure Corporation installed a small (50 barrels per day), continuous flow demonstration unit at Valero's Krotz Spring refinery in the spring of 2003. It appears that this technology could reduce the cost of producing 15 ppm diesel fuel for some refiners compared to conventional hydrotreating. However, the small size of the demonstration unit may make the risk associated with a new technology too large. Thus, we believe that this technology needs be demonstrated further before most refiners will seriously considered it for commercial application. This technology, however, may be ideal for use at transmix processing plants or large terminals to reprocess 15 ppm diesel fuel which have become contaminated during shipment. We discuss this distillate downgrade in greater detail in Section VI.A.2 of this preamble. This oxidation process avoids the need for high pressure hydrogen, which is usually not economically available at these smaller facilities.

Finally, Conoco-Phillips has adapted their S-Zorb adsorption technology which was originally designed for gasoline desulfurization, for diesel fuel desulfurization. At the time of the NPRM, Conoco-Phillips had signed 23 licensing agreements with refiners in North America regarding the use of S-Zorb to comply with the Tier 2 gasoline sulfur standards. Furthermore, Conoco-Phillips had plans for the quick installation of an S-Zorb unit to demonstrate the production of 15 ppm diesel fuel. However, we have since learned that Conoco-Phillips has dropped its plans to build a commercial demonstration unit for desulfurizing diesel fuel. Without a commercial unit operating in the 2006 time frame, we do not believe that many refiners will seriously consider S-Zorb to produce 15 ppm NRLM diesel fuel in 2010 and 2012.

Due to the fact that the Process Dynamics IsoTherming process is already operating commercially and operational data indicate a 30 percent reduction in the cost of producing 15 ppm fuel relative to conventional hydrotreating, we project that 60 percent of the new volume of 15 ppm NRLM diesel fuel will be produced using this technology. We project that the remaining 40 percent of 15 ppm NRLM diesel fuel will use extensions of conventional hydrotreating. We assume this 60/40 mix of Isotherming and extensions of conventional hydrotreating, respectively, for 2010, 2012 and even for 2014 when the small refiners exemptions expire.

API commented that the advanced desulfurization technologies have not been commercially demonstrated and thus should not be used as the basis for estimating the cost of desulfurizing NRLM diesel fuel to 15 ppm. While this is true for the Unipure oxidation and Conoco-Phillip's S-Zorb processes, the Process Dynamics IsoTherming process has been commercially demonstrated. It is therefore appropriate for use as a partial basis for the refining costs associated with today's final rule. To indicate the effect that this projection for the use of IsoTherming has on the rule’s cost, in Section 7.2.2 of the Final RIA, we estimate the cost of producing 15 ppm NRLM fuel with only the use of conventional hydrotreating technology.

5. Is the Leadtime Sufficient to Meet the 2010 and 2012 15 ppm NRLM Sulfur Cap?

We project that 32 refineries will produce 15 ppm nonroad diesel fuel in 2010, with two of these being owned by small refiners. In 2012, we project that 15 refineries will produce 15 ppm locomotive and marine diesel fuel. We project that an additional 15 refineries will produce 500 ppm nonroad diesel fuel in 2010 under the small refiner provisions included in the today's final rule. Then in 2014, we project that the 15 refineries exempted under the small refiner provisions will begin producing 15 ppm NRLM diesel fuel in 2014.

The timing of this rule provides refiners and importers with more than six years before they will have to produce 15 ppm nonroad diesel fuel, and two years more for producing 15 ppm locomotive and marine diesel fuel. Our leadtime analysis, which is presented in Section 5.4.2 of the Final RIA, projects that 30-39 months are typically needed to design and construct a diesel fuel hydrotreater, perhaps less if it is a Process Dynamics unit. Thus, refiners will have about three years before they would have to begin detailed design and construction for 2010, and five years before 2012. This will allow sufficient time to consult with vendors, test their diesel fuel in pilot plants to assess the difficulty of its desulfurization via a variety of technologies, and to select its technology for 2010 and 2012. In addition, these refiners will also have the chance to observe the performance of the hydrotreaters being used to produce 15 ppm highway diesel fuel for at least one year for those complying in 2010, and two years more for those complying in 2012. While not a full catalyst cycle, any unusual degradation in catalyst performance should be apparent within the first year. Based on the pre-compliance reports, some refineries in the U.S. will be producing 15 ppm sulfur highway diesel fuel earlier than 2006. Some refineries are expected to produce complying fuel earlier than the compliance date in Europe as well. The refineries which are complying early will accrue experience earlier and longer providing refiners a better sense of the reliability of producing 15 ppm diesel fuel. Thus, we project that the 2010 and 2012 start dates will allow refiners to be quite certain that the designs they select in mid-2007 will perform adequately in 2010 and 2012.

In addition, refiners will have three to four years or more to observe the performance of the Process Dynamics IsoTherming process before having to make their technology selections for 2010 and 2012 . This should be more than adequate to fully access the costs and capabilities of this technology for all but the most cautious refiners.

Considering the amount of leadtime available and the desulfurization technologies which will be available and proven for complying with a 15 ppm sulfur standard, we do not expect that the leadtime for complying with the 15 ppm NRLM cap standard in 2010 and 2012 will be an issue for refiners.

6. Feasibility of Distributing 500 and 15 ppm NRLM Fuel

There are two considerations with respect to the feasibility of distributing non-highway diesel fuels meeting the sulfur standards in today's rule. The first pertains to whether sulfur

contamination can be adequately managed throughout the distribution system so that fuel delivered to the end-user does not exceed the specified maximum sulfur concentration. The second pertains to the physical limitations of the system to accommodate any additional segregation of product grades.

a. Limiting Sulfur Contamination

With respect to limiting sulfur contamination during distribution, the physical hardware and distribution practices for non-highway diesel fuel do not differ significantly from those for highway diesel fuel. Therefore, we do not anticipate any new issues with respect to limiting sulfur contamination during the distribution of non-highway fuel that would not have already been accounted for in distributing highway diesel fuel. Highway diesel fuel has been required to meet a 500 ppm sulfur standard since 1993. Thus, we expect that limiting contamination during the distribution of 500 ppm non-highway diesel engine fuel can be readily accomplished by the industry. This applies to locomotive and marine diesel fuel as well as nonroad diesel fuel.

In the highway diesel rule, EPA acknowledged that meeting a 15 ppm sulfur specification would pose a substantial new challenge to the distribution system. Refiners, pipelines, and terminals would have to pay careful attention to and eliminate any potential sources of contamination in the system (e.g., tank bottoms, deal legs in pipelines, leaking valves, interface cuts, etc.). In addition, bulk plant operators and delivery truck operators would have to carefully observe recommended industry practices to limit contamination, including practices as simple as cleaning out transfer hoses, proper sequencing of fuel deliveries, and parking on a level surface when draining the storage tank. Due to the need to prepare for compliance with the highway diesel program, we anticipate that issues related to limiting sulfur contamination during the distribution of 15 ppm NRLM diesel fuel will be resolved well in advance of the 2010 and 2012 implementation dates . We are not aware of any additional issues that might arise unique to NRLM diesel fuel. If anything we anticipate limiting contamination will become easier as batch sizes are allowed to increase and potential sources of contamination decrease as more and more of the diesel pool turns over to 500 and 15 ppm sulfur. Industry representatives acknowledge that the task can be accomplished. However, they are still in the process of identifying all of the measures that will need to be taken.

b. Potential Need for Additional Product Segregation

As discussed in section IV.D, we have designed the NRLM diesel fuel program to minimize the need for additional product segregation and the feasibility and cost issues associated with it. This final rule allows for the fungible distribution of 500 ppm highway and 500 ppm sulfur NRLM diesel fuel in 2007, and 15 ppm highway and 15 ppm NR diesel fuel in 2010 and 15 ppm NRLM diesel fuel in 2012, up until the point where NRLM, LM, or nonroad fuel must be dyed for IRS excise tax purposes. We proposed that heating oil would be required to be segregated throughout the distribution system by the use of a marker added at the refiners from 2007 through 2010. We received comments that addition of the marker at the refinery would

cause significant concerns regarding potential marker contamination in the jet fuel. In responding to these and other comments, we have chosen to adopt a designate and track system of ensuring refiner compliance with desulfurization requirements (see IV.D.). This allows the point of marker addition to be moved downstream to the terminal where such contamination concerns are minimal. As a result heating oil and high-sulfur NRLM will also be fungible in the distribution system up to the point where the fuel marker must be added at the terminal.[135]

The design of today's fuel program eliminates any potential feasibility issues associated with the need for product segregation. This is not to say that additional steps will not have to be taken. However, this program will result in only a limited number of entities in the distribution system choosing to add new tankage due to new product segregation. Bulk plants in areas of the country where heating oil is expected to remain in the market will have to decide whether to add tankage to distribute both heating oil and 500 ppm sulfur NRLM fuel. Terminal operators commented that the proposed presence of a fuel marker in heating oil would make it impossible for them to blend 500 ppm sulfur diesel from 15 ppm sulfur and high sulfur fuels. They related that this ability would be important to certain terminal operators who would not have the storage facilities available for three grades of diesel fuel, but would still not wish to forgo selling 500 ppm diesel fuel.[136] Today's rule allows the required marker to be added to heating oil before it leaves the terminal (see section IV.D of this preamble). Therefore, terminals will be able to blend 500 ppm diesel from 15 ppm and high sulfur diesel fuels, provided they fulfill all of the responsibilities associated with acting as a fuel refiner (see section V of this preamble).[137] However, because this will be a relatively costly way of producing 500 ppm diesel fuel, we do not expect that the practice will be widespread. In all other cases we anticipate segments of the distribution system will choose to avoid any fuel segregation costs by limiting the range of sulfur grades they choose to carry, just as they do today. Regardless, however, the costs and impacts of these choices are small. A more detailed explanation of this assessment can be found in chapter 7 of the RIA.

A limited volume of 500 ppm sulfur diesel fuel is projected to be produced downstream due to interface mixing in the distribution system (see section IV.A).[138] Fuel from these sources is

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[135] The fuel marker requirements only apply outside of the Northeast/Mid-Atlantic area. Inside the Northeast/Mid-Atlantic area, high sulfur NRLM cannot be sold to end users. See section IV.D for a detailed discussion of the fuel marker provisions.

[136] 15 ppm diesel fuel and high sulfur heating oil will be the largest volume products at such terminals.

[137] The definition of a refiner includes persons who produce highway or NRLM diesel fuel by blending.

[138] This fuel will be produced by transmix processors and at terminals by segregating the pipeline interface between 15 ppm diesel fuel and jet fuel.

currently sold into the NRLM and heating oil markets. The implementation of the 15 ppm sulfur standard for NR diesel fuel in 2010 and for LM diesel fuel in 2012 raises the concern that the heating oil market might be insufficient to absorb all such downstream 500 ppm sulfur diesel fuel in areas outside of the Northeast (where most heating oil is used). If the market for this fuel was limited, it would have to be trucked back to a refinery to be desulfurized which could raise significant logistical and cost issues. Consequently, today's rule provides that 500 ppm sulfur diesel fuel produced due to interface mixing can continue to be used in nonroad equipment until 2014 (subject to specific sulfur requirements for new equipment), and in locomotive and marine engines indefinitely.[139] These provisions ensure that there will be a sufficient market for such 500 ppm sulfur diesel fuel.

G. What Are the Potential Impacts of the 15 ppm Sulfur Diesel Program on Lubricity and Other Fuel Properties?

1. What Is Lubricity and Why Might it Be a Concern?

Engine manufacturers and owner/operators depend on diesel fuel lubricity properties to lubricate and protect moving parts within fuel pumps and injection systems for reliable performance. Unit injector systems and in-line pumps, commonly used in diesel engines, are actuated by cams lubricated with crankcase oil, and have minimal sensitivity to fuel lubricity. However, rotary and distributor type pumps, commonly used in light and medium-duty diesel engines, are completely fuel lubricated, resulting in high sensitivity to fuel lubricity. The types of fuel pumps and injection systems used in nonroad diesel engines are the same as those used in highway diesel vehicles. Consequently, nonroad and highway diesel engines share the same need for adequate fuel lubricity to maintain fuel pump and injection system durability.

Diesel fuel lubricity concerns were first highlighted for private and commercial vehicles during the initial implementation of the federal 500 ppm sulfur highway diesel program and the state of California's diesel program. The Department of Defense (DoD) also has a longstanding concern regarding the lubricity of distillate fuels used in its equipment as evidenced by the implementation of its own fuel lubricity improver performance specification in 1989.[140] The diesel fuel requirements in the state of California differed from the federal requirements by substantially restricting the aromatic content of diesel fuel which requires more severe

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[139] While today's rule does not contain an end date for the downstream distribution of 500 ppm sulfur locomotive and marine fuel, we will review the appropriateness of allowing this flexibility based on experience gained from implementation of the 15 ppm sulfur NRLM diesel fuel standard. We expect to conduct such an evaluation in 2011.

[140] DoD Performance Specification, Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble, MIL-PRF-25017F, 10 November 1997, Superseding MIL-I-25017E, 15 June 1989.

hydrotreating than reducing the sulfur content to meet a 500 ppm standard.[141] Consequently, concerns regarding diesel fuel lubricity have primarily been associated with California diesel fuel and some California refiners treat their diesel fuel with a lubricity additive as needed. Outside of California, hydrotreating to meet the current 500 ppm sulfur specification does not typically result in a substantial reduction of lubricity. Diesel fuels outside of California seldom require the use of a lubricity additive. Therefore, we anticipate only a marginal increase in the use of lubricity additives in NRLM diesel fuel meeting the 500 ppm sulfur standard for 2007.[142] Today's action requires diesel fuel used in nonroad, locomotive, and marine diesel engines to meet a 15 ppm sulfur standard in 2010 and 2012, respectively. Based on the following discussion, we believe that the increase in the use of lubricity additives in 15 ppm sulfur NRLM diesel fuel would be the same as that estimated for 15 ppm highway diesel fuel.

The state of California currently requires the same standards for diesel fuel used in nonroad equipment as in highway equipment. Outside of California, highway diesel fuel is often used in nonroad equipment when logistical constraints or market influences in the fuel distribution system limit the availability of high sulfur fuel. Thus, for nearly a decade nonroad equipment has been using federal 500 ppm sulfur diesel fuel and California diesel fuel, some of which may have been treated with lubricity additives. During this time, there has been no indication that the level of diesel lubricity needed for fuel used in nonroad engines differs substantially from the level needed for fuel used in highway diesel engines.

Blending small amounts of lubricity-enhancing additives increases the lubricity of poor-lubricity fuels to acceptable levels. These additives are available in today's market, are effective, and are in widespread use around the world. Among the available additives, biodiesel has been suggested as one potential means for increasing the lubricity of conventional diesel fuel. Indications are that low concentrations of biodiesel might be sufficient to raise the lubricity to acceptable levels. Biodiesel is a renewable fuel made from agricultural sources such as soybean oil, peanut oil and other vegetable oils as well as rendered and animal fats and recycled cooking oils. Biodiesel generally contains very low amounts of sulfur, which is an attractive characteristic for use in diesel engines using advanced aftertreatment systems. Additionally, biodiesel, by virtue of its lubricity properties, may be a good alternative to additives currently used to ensure adequate fuel lubricity. According to the U.S. Department of Agriculture, there is a current capacity to produce 100 million gallons annually. Thus, we believe that biodiesel is a feasible technology that could help support today's clean diesel fuel program.

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[141] Chevron Products Diesel Fuel Technical Review provides a discussion of the impacts on fuel lubricity of current diesel fuel compositional requirements in California versus the rest of the nation; see http://www.chevron.com/prodserv/fuels/bulletin/diesel/l2%5F7%5F2%5Frf.htm.

[142] The cost from the increased use of lubricity additives in 500 ppm NRLM diesel fuel in 2007 and in 15 ppm nonroad diesel fuel in 2010 and locomotive and marine diesel fuel in 2012 is discussed in section VI of this preamble.

Research remains to be performed to better understand which fuel components are most responsible for lubricity. Consequently, it is unclear whether and to what degree the sulfur standards for NRLM diesel fuel will impact fuel lubricity. Nevertheless, there is evidence that the typical process used to remove sulfur from diesel fuel – hydrotreating – can impact lubricity depending on the severity of the treatment process and characteristics of the crude. We expect that hydrotreating will be the predominant process used to reduce the sulfur content of NRLM diesel fuel to meet the 500 ppm sulfur standard during the first step of the program. Similarly, we project that both conventional hydrotreating and the Linde Isotherming process will be used to meet the 15 ppm sulfur standard for NRLM diesel fuel.

Based on our comparison of the blendstocks and processes used to manufacture non-highway diesel fuels, we believe that the potential decrease in the lubricity of these fuels from hydrotreating that might result from the sulfur standards should be approximately the same as that experienced in desulfurizing highway diesel fuel.[143] To provide a conservative, high cost estimate, we assumed that the potential impact on fuel lubricity from the use of the new desulfurization processes would be the same as that experienced when hydrotreating diesel fuel to meet a 15 ppm sulfur standard. Given that the requirements for fuel lubricity in highway and nonroad engines are the same, and the potential decrease in lubricity from desulfurization of NRLM diesel fuel would be no greater than that experienced in desulfurizing highway diesel fuel, we estimate that the potential need for lubricity additives in NRLM diesel fuel under today's action would be the same as that for highway diesel fuel meeting the same sulfur standard.

a. Farm and Mining Equipment

The types of fuel pumps and injection systems used in the nonroad diesel engines found in farm and mining equipment are similar to those used in highway diesel vehicles.[144] The hydrotreating process for generating 500 ppm diesel fuel will not adversely effect fuel injection equipment in farm and mining equipment based on the use of comparable injection systems in highway diesel vehicles. We believe that the use of lubricity additives in 15 ppm sulfur NRLM diesel fuel will be required and result in adequate protection of fuel injection equipment and is similar to that needed for 15 ppm sulfur highway diesel fuel.

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[143] See chapter 5 of the RIA for a discussion of the potential impacts on fuel lubricity of this proposal.

[144] Nonroad and highway diesel engines meeting similar emissions standards use similar fuel systems provided by common suppliers. For example, a nonroad engine meeting the 2001 Tier 2 nonroad diesel engine emission standards would have the same fuel system as a highway diesel engine meeting the 1998 highway diesel engine emissions standards.

b. Locomotives

One of the locomotive manufacturers expressed concern in its comments that low sulfur fuel might damage existing locomotives. However, the manufacturer provided no evidence to show that such damage would likely occur. Locomotives already use a significant amount of low sulfur fuel, especially in California, and we have not seen any evidence of sulfur-related problems. The railroads expressed a similar concern, but acknowledged that any potential problems would be manageable with sufficient lead time. At this time, we see no reason for any special concern related to locomotives using low sulfur fuel.

2. A Voluntary Approach on Lubricity

In the United States, there is no government or industry standard for diesel fuel lubricity. Therefore, specifications for lubricity are determined by the market. Since the beginning of the 500 ppm sulfur highway diesel program in 1993, refiners, engine manufacturers, engine component manufacturers, and the military have been working with ASTM to develop protocols and standards for diesel fuel lubricity in its D 975 specifications for diesel fuel. ASTM is working towards a single lubricity specification that is applicable to all diesel fuel used in any type of engine. Although ASTM has not yet adopted specific protocols and standards, refiners that supply the U.S. market have been treating diesel fuel with lubricity additives on a batch by batch basis, when poor lubricity fuel is produced. ASTM's target implementation date for this specification is January 1, 2005.

The potential need for lubricity additives in diesel fuel meeting a 15 ppm sulfur specification was evaluated during the development of EPA's highway diesel rule. In response to the proposed highway diesel rule, all comments submitted regarding lubricity either stated or implied that the proposed sulfur standard of 15 ppm would likely cause the refined fuel to have lubricity characteristics that would be inadequate to protect fuel injection equipment, and that mitigation measures such as lubricity additives would be necessary. However, the commenters suggested varied approaches for addressing lubricity. For example, some suggested that we need to establish a lubricity requirement by regulation while others suggested that the current voluntary, market based system would be adequate. The Department of Defense recommended that we encourage the industry (ASTM) to adopt lubricity protocols and standards before the 2006 implementation date of the 15 ppm sulfur standard for highway diesel fuel.

The final highway diesel rule did not establish a lubricity standard for highway diesel fuel. We believe the issues related to the need for diesel lubricity in fuel used in nonroad diesel engines are substantially the same as those related to the need for diesel lubricity for highway engines. Consequently, we expect the same industry-based voluntary approach to ensuring adequate lubricity in nonroad diesel fuels that we recognized for highway diesel fuel. We believe the best approach is to allow the market to address the lubricity issue in the most economical manner, while avoiding an additional regulatory scheme. A voluntary approach should provide adequate customer protection from engine failures due to low lubricity, while providing the maximum

flexibility for the industry. This approach would be a continuation of current industry practices for diesel fuel produced to meet the current federal and California 500 ppm sulfur highway diesel fuel specifications, and benefits from the considerable experience gained since 1993. It would also include any new specifications and test procedures that we expect would be adopted by ASTM regarding lubricity of NRLM diesel fuel quality.

In any event, this is an issue that will be resolved to meet the demands of the highway diesel market, and whatever resolution is reached for highway diesel fuel could be applied to NRLM diesel fuel with sufficient advance notice. We are continuing to participate in the ASTM Diesel Fuel Lubricity Task Force[145] and will assist their efforts to finalize a lubricity standard. We are hopeful that ASTM can reach a consensus this summer at the next meeting of the ASTM's Lubricity Task Force. If for some reason ASTM does not take action to set a lubricity specification, EPA will consider taking appropriate action to ensure 15 ppm sulfur diesel fuel has adequate lubricity.

3. What Other Impact Would Today's Actions Have on the Performance of Diesel and Other Fuels?

We do not expect that the fuel program finalized today will have any negative impacts on the performance of diesel engines in the existing fleet which would use the fuels regulated today.

While the process of lowering sulfur levels to 500 ppm does lower polynuclear aromatic hydrocarbons (PNAs) and total aromatics in general, it does not achieve the near-zero levels previously seen in California. The 15 ppm sulfur standard will further reduce PNAs, however, in most diesel fuel, there will still be PNAs present. Furthermore, since the 1990's, diesel engine manufacturers have switched to alternative materials (such as Viton), which do not experience leakage when PNAs are reduced. We believe that there will be no issues with leaking fuel pump O-rings with the changes in diesel fuel sulfur levels required by this rulemaking.

The moderate reduction in PNAs and total aromatics associated with the hydrotreating of diesel fuel will tend to increase the cetane index and number of diesel fuel. This will improve the driveability of vehicles operating on this higher cetane diesel fuel.

We do not expect any negative impacts on other fuels, such as jet fuel or heating oil. We do expect that the sulfur levels of heating oil may decrease because of this rulemaking . Beginning in mid-2007, we expect that controlling NRLM diesel fuel to 500 ppm sulfur will lead many pipelines to discontinue carrying high sulfur heating oil as a separate grade. In areas served by these pipelines, heating oil users will likely switch to 500 ppm sulfur diesel fuel. This will reduce emissions of SO_2 and sulfate PM from furnaces and boilers fueled with heating oil. The primary exception to this will likely be the Northeast, where a distinct higher sulfur heating oil will still be distributed as a separate fuel. Also, we expect that a small volume of moderate sulfur

[145] ASTM sub committee D02.E0.

distillate fuel will be created during distribution from the mixing of low sulfur diesel fuels and higher sulfur fuels, such as jet fuel in the pipeline interface. Such moderate sulfur distillate will often be sold by the terminal as high sulfur heating oil, but in fact its sulfur level will be lower than that normally sold as heating oil.

H. Refinery Air Permitting

Prior to beginning diesel desulfurization projects, some refineries may be required to obtain a preconstruction permit, under the New Source Review (NSR) program, from the applicable state/local air pollution control agency.[146] We believe that today's program provides sufficient lead time for refiners to obtain any necessary NSR permits well in advance of the applicable compliance dates.

Given that today's diesel sulfur program provides roughly three years of lead time before the 500 ppm standard takes effect, we believe refiners will have time to obtain any necessary preconstruction permits. In addition, the experience gained by many refineries to obtain the preconstruction permits needed to comply with the Tier 2 and highway diesel fuel programs should benefit them in obtaining the necessary permits to comply with today's new diesel fuel requirements. Nevertheless, we believe it is reasonable to continue our efforts under the Tier 2 and highway diesel fuel programs, to help states in facilitating the issuance of permits under the NRLM diesel fuel sulfur program whenever such assistance may be needed and requested. We anticipate that such assistance may include both technical and procedural assistance as would be provided by the appropriate EPA Regional and Headquarters offices. Finally, to facilitate the processing of permits, we encourage refineries to begin discussions with permitting agencies and to submit permit applications as early as possible.

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[146] Hydrotreating diesel fuel involves the use of process heaters, which have the potential to emit pollutants associated with combustion, such as NO_X, PM, CO and SO_2. In addition, reconfiguring refinery processes to add desulfurization equipment could increase fugitive VOC emissions. The emissions increases associated with diesel desulfurization would vary widely from refinery to refinery, depending on many source-specific factors, such as crude oil supply, refinery configuration, type of desulfurization technology, amount of diesel fuel produced, and type of fuel used to fire the process heaters.

V. Nonroad, Locomotive and Marine Diesel Fuel Program: Details of the Compliance and Enforcement Provisions

As with earlier fuel programs, we have developed a comprehensive set of compliance and enforcement provisions designed to promote effective and efficient implementation of this fuel program and thus to achieve the full environmental potential of the program. The compliance provisions under today's final rule are designed to ensure that nonroad, locomotive, and marine diesel fuel sulfur content requirements are met throughout the distribution system, from the refiner or importer through to the end user, subject to certain provisions applicable during the early transition years. Section IV above describes our program for the reduction of sulfur in nonroad, locomotive and marine (NRLM) diesel fuel including the standards and basic design of the compliance and enforcement program. This section contains additional details regarding the compliance and assurance program. The provisions discussed in this section fall into several broad categories:

- Special fuel provisions and exemptions;
- Additional provisions applicable to refiners and importers;
- Additional provisions applicable to parties downstream of the refinery or importer;
- Special provisions regarding additives, kerosene, and the prohibition against the use of motor oil in fuel;
- Fuel testing and sampling requirements;
- Records required to be kept, including those applying under the designate and track, credit provisions, small refiner, and refiner hardship provisions;
- Reporting requirements;
- Exemptions from the program;
- Provisions concerning liability, defenses, and penalties for noncompliance; and
- The selection of the marker for heating oil and 500 ppm sulfur LM diesel fuel. (The specific requirements with respect to heating oil and 500 ppm sulfur LM diesel fuel inside and outside of the Northeast/Mid-Atlantic Area are discussed in section IV.D.)

A. Special Fuel Provisions and Exemptions

As discussed in section IV.A.1 above, the sulfur standards in today's rule generally cover all the diesel fuel that is intended for use in or used in nonroad, locomotive, and marine (NRLM) applications that is not already covered by the standards for highway diesel fuel. For the purposes of this preamble, this fuel is defined primarily by the type of engine which it is used to power: land-based nonroad, locomotive, and marine diesel engines. Section IV.A.1 above also describes several types of petroleum distillate that are not covered by the sulfur standards promulgated today, including jet fuel and heating oil, provided they are not used in NRLM engines. The following paragraphs discuss several provisions and exemptions for NRLM diesel fuel that will apply in special circumstances.

1. Fuel Used in Military Applications

NRLM diesel fuel used in military applications is treated in the same manner as under the recent highway diesel rule. Refiners are not required to produce these fuels to the NRLM standards. However, at the same time, their use is limited only to certain military applications. NRLM diesel fuel is defined so that JP-5, JP-8, F76, and any other military fuel that is used or intended for use in NRLM diesel engines or equipment is initially subject to all of the requirements applicable to NRLM diesel fuel. However, today's rule also exempts these military fuels from the diesel fuel sulfur content and other requirements in certain circumstances. First, these fuels are exempt if they are used in tactical military motor vehicles or nonroad engines, or equipment that have a national security exemption from the vehicle or engine emissions standards. Due to national security considerations, EPA's existing regulations allow the military to request and receive national security exemptions (NSE) for their motor vehicles and NRLM diesel engines and equipment from emissions regulations if the operational requirements for such vehicles, engines, or equipment warrant such an exemption. This final rule does not change these provisions. Fuel used in these applications is exempt. Second, these fuels are also exempt if they are used in tactical military vehicles, engines, or equipment that are not covered by a national security exemption but, for national security reasons (such as the need to be ready for immediate deployment overseas), these vehicles, engines, and equipment need to be fueled on the same fuel as vehicles, engines, or equipment with a national security exemption. Use of JP-5, JP-8, F76, or any other fuel not meeting NRLM diesel fuel standards in a motor vehicle or NRLM diesel engine or equipment other than the those described above is prohibited under today's rule.

EPA and the Department of Defense have developed a process to address the tactical vehicles, engines, and equipment covered by the diesel fuel exemption and are discussing whether changes to it might be appropriate. Based on data provided by the Department of Defense to date in the context of implementing a similar exemption provision in the highway program, EPA believes that providing an exemption for military fuel used in tactical nonroad engines and equipment will not have any significant environmental impact.

The Department of Defense (DoD) commented that EPA should reconsider its determination that the definition of diesel fuel includes JP8 and JP5. DoD cited a 1995 letter from EPA which stated that there was insufficient reason to conclude that JP-8 is commonly and commercially known as diesel fuel under the then applicable definition of motor vehicle diesel fuel. Since the time of this letter, EPA has become aware of a substantial number of cases of the misuse of aviation turbine fuel in highway engines. The potential for misuse of JP-8 or similar fuels in NRLM equipment where no national security exemption exists would remain. To ensure that NRLM equipment is properly fueled with low sulfur fuel, the definition of NRLM diesel fuel has been written to encompass all diesel or other distillate fuels used or intended for use in NRLM engines, which would include JP-8 and JP-5. Furthermore, the provisions in today's rule allow vehicles, engines, and equipment to be fueled with military specification fuels that are exempt from the sulfur standards when needed for national security. We believe that this provides DoD

with the needed flexibility to meet its goals of keeping vehicles, engines, and equipment ready for quick deployment overseas.

2. Fuel Used in Research, Development, and Testing

Today's final rule permits parties to request an exemption from the sulfur or other standards for NRLM diesel fuel used for research, development and testing purposes ("R & D exemption"). We recognize that there may be legitimate research programs that require the use of diesel fuel with higher sulfur levels than allowed under today's rule. As a result, this final rule contains provisions for obtaining an exemption from the prohibitions for persons, producing, distributing, transporting, storing, selling, or dispensing NRLM diesel fuel that exceeds the standards, where such diesel fuel is necessary to conduct a research, development, or testing program.

Parties seeking an R & D exemption must submit an application for exemption to EPA that describes the purpose and scope of the program, and the reasons why higher-sulfur diesel fuel is necessary. Upon presentation of the required information, an exemption can be granted at the discretion of the Administrator, with the condition that EPA can withdraw the exemption in the event the Agency determines the exemption is not justified. In addition, an exemption based on false or inaccurate information will be considered void *ab initio*. Fuel subject to an exemption is exempt from certain provisions of this rule, including the sulfur standards, provided certain requirements are met. These requirements include the segregation of the exempt fuel from non-exempt NRLM and highway diesel fuel, identification of the exempt fuel on PTDs, pump labeling, and where appropriate, the replacement, repair, or removal from service of emission systems damaged by the use of the high sulfur fuel.

3. Fuel Used in Racing Equipment

There are no provisions for an exemption from the sulfur or other content standard and other requirements for diesel fuel used in racing in today's final rule. Under certain conditions, racing vehicles are not considered nonroad vehicles. See, for example, 40 CFR § 89.2, definition of "nonroad vehicle." The fuel used by such racing vehicles would not necessarily be considered nonroad diesel fuel. However, we believe that there is a realistic chance that such fuel also could be used in NRLM equipment, and therefore, should be considered NRLM diesel fuel. We received no comments supporting the need for an exemption for racing fuel. We are not aware of any advantage for racing vehicles or racing equipment to use fuel having higher sulfur levels than are required by this rule, and we are concerned about the potential for misfueling of nonroad equipment and motor vehicles that could result from having a high sulfur (e.g., 3,000 ppm) fuel for vehicle or nonroad equipment available in the marketplace. Consequently, as was the case with the highway diesel rule, this final rule does not provide an exemption from the nonroad diesel fuel requirements for fuel used in racing vehicles or equipment.

4. Fuel for Export

Fuel produced for export, and that is actually exported for use in a foreign country, is exempt from the fuel content standards and other requirements of this final rule. Such fuel will be considered as intended for use in the U.S. and subject to the standards in today's rule unless it is designated by the refiner as for export only and PTDs state that the fuel is for export only. Fuel intended for export must be segregated from all fuel intended for use in the U.S., and distributing or dispensing such fuel for domestic use is illegal.

B. Additional Requirements for Refiners and Importers

The primary requirements for refiners and importers under today's final rule are discussed in section IV above. In that section, we discuss the general structure of the compliance and enforcement provisions applicable to refiners and importers, including fuel content standards, fuel volume designation and tracking provisions, and credit provisions. In this subsection, we discuss several additional requirements for refiners and importers that are not addressed in section IV. In addition, sections V.G, V.H, and V.I below discuss several provisions that apply to all parties in the diesel fuel production and distribution system, including refiners and importers.

1. Transfer of Credits

This final rule includes provisions for NRLM diesel sulfur credit transfers that are essentially identical to other fuels rules that have credits provisions. As in other fuels rules, NRLM diesel sulfur credits can only be transferred between the refiner or importer generating the credits and the refiner or importer using the credits. If a credit purchaser can not use all the credits it purchased from the refiner who generated them, the credits can be transferred one additional time. We recognize that there is potential for credits to be generated by one party and subsequently purchased and used in good faith by another party, where the credits are later found to have been calculated or created improperly, or otherwise found to be invalid. As with the reformulated gasoline rule, the Tier 2/Gasoline Sulfur rule, and the highway diesel sulfur rule, invalid credits purchased in good faith are not valid for use by the purchaser. To allow such use would not be consistent with the environmental goals of the regulation. In addition, both the seller and purchaser of invalid credits must adjust their credit calculations to reflect the proper credits and either party (or both) can be deemed in violation if the adjusted calculations demonstrated noncompliance. We expect that the parties to such a credit transaction will develop contractual provisions to address these circumstances.

Nevertheless, in a situation where invalid credits are transferred, our strong preference will be to hold the credit seller liable for the violation, rather than the credit purchaser. As a general matter we expect to enforce a shortfall in credit compliance calculations against the credit seller, and we expect to enforce a compliance shortfall (caused by the good faith purchase of invalid credits) against a good faith purchaser only in cases where we are unable to recover sufficient valid credits from the seller to cover the shortfall. Moreover, in settlement of such cases we will

strongly encourage the seller to purchase credits to cover the good faith purchaser's credit shortfall. EPA will consider the covering of a credit deficit through the purchase of valid credits a very important factor in mitigation of any case against a good faith purchaser, whether the purchase of valid credits is made by the seller or by the purchaser.

2. Additional Provisions for Importers and Foreign Refiners Subject to the Credit Provisions or Hardship Provisions

Since this final rule includes several compliance options that can be used by NRLM diesel fuel importers and foreign refiners, we are also finalizing specific compliance and enforcement provisions to ensure compliance for imported NRLM diesel fuel. These additional foreign refiner provisions are similar to those under the gasoline anti-dumping regulations, the gasoline sulfur regulations and the highway diesel fuel regulations (see 40 CFR § 80.94, § 80.410, and § 80.620).

Under today's final rule, the per gallon standards for NRLM diesel fuel produced by refineries owned by foreign refiners must be met by the importer, unless the foreign refiner has been approved to produce NRLM diesel fuel under the credit provisions, small refiner provisions or hardship provisions of this final rule. If the foreign refiner is approved under any of these provisions, the volume and other requirements must be met by the foreign refiner for its refinery(s) and the foreign refiner must be the entity(s) generating, using, banking or trading any credits for the NRLM diesel fuel produced for and imported into the U.S. Importers themselves are not eligible for small refiner or hardship relief as they do not face the same capital cost and lead-time issues faced by refiners. Importers may participate in the credit programs, however, an importer and a foreign refiner may not generate credits for the same fuel.

Any foreign refiner that produces NRLM diesel fuel subject to the credit provisions, small refiner provisions or the hardship provisions will be subject to the same requirements as domestic refiners operating under the same provisions. Additionally, provisions for foreign refiners exist that are similar to the provisions at 40 CFR § 80.94, § 80.410, and § 80.620, which include:

- Segregation of NRLM diesel fuel produced at the foreign refinery until it reaches the U.S. and separate tracking of volumes imported into each PADD;
- Controls on product designation;
- Load port and port of entry testing; and
- Requirements regarding bonds and sovereign immunity.

These provisions will aid the Agency in tracking NRLM diesel fuel from the foreign refinery to its point of import into this country. We believe these provisions are necessary and sufficient to ensure that foreign refiners' compliance can be monitored and that the diesel fuel requirements in today's rule can be enforced against foreign refiners.

3. Diesel Fuel Treated as Blendstock (DTAB)

Under today's program, a situation could arise for importers where fuel that was expected to comply with the 15 ppm sulfur NRLM standard is found to be slightly higher in sulfur than the standard. Rather than require that importer to account for, and report, that fuel as 500 ppm sulfur fuel, an importer will be able to designate the non-complying fuel as blendstock – "diesel fuel treated as blendstock" or DTAB – rather than as NRLM diesel fuel. In its capacity as a refiner, the party can then blend this DTAB fuel with lower sulfur diesel fuel or with other blendstocks to cause the sulfur level of the combined product to meet the 15 ppm sulfur NRLM diesel fuel standard prior to delivery to another entity. The same situation exists with respect to compliance with the 15 ppm sulfur highway standard. However, no provision was made in the 2007 highway final rule for this. Consequently, we are also finalizing these DTAB provisions in this final rule for application to 15 ppm sulfur highway diesel fuel.

Where diesel fuel that has been previously designated by a refiner is used to reduce the sulfur level of the DTAB to 15 ppm or less, the party, in its refiner capacity, is required to report only the volume of the imported DTAB as the amount of diesel fuel produced.[147] This avoids the double counting that would result if the same diesel fuel is reported twice (i.e., once by the refiner who originally produced it and again by the refiner using it to blend with DTAB). If the product that is blended with the DTAB is not previously designated diesel fuel, but is also blendstock, the total combined volume of the DTAB and other blendstock constitutes the batch produced.

When an importer classifies diesel fuel as DTAB, that DTAB does not count toward the importer's calculations under the highway diesel rule's temporary compliance option, toward credit generation or use, or for volume account balance compliance calculations (see section IV).[148] The same party, however, must include the DTAB in such calculations in its capacity as a refiner. We believe such an approach will increase the supply of 15 ppm sulfur fuel by reducing the volume of near-compliant fuel that is downgraded to higher sulfur designations. In essence, it allows importers the same flexibility that refiners have within their refinery gate.

Similar to the provisions discussed above regarding the manufacture of 15 ppm sulfur diesel fuel using DTAB, 500 ppm sulfur NRLM and highway diesel fuel can also be manufactured using DTAB provided that this is appropriately reflected in the importer's compliance calculations.

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[147] Volumes of previously designated diesel fuel would be reported as volumes received under the designate and track provisions of Section IV.D.

[148] Importer/refiners availing themselves of the DTAB provisions are still subject to the downgrading provisions, and other provisions applicable to any importer or refiner.

C. Requirements for Parties Downstream of the Refinery or Import Facility

In order for the environmental benefits of the NRLM diesel program to be realized, parties in the fuel distribution system downstream of the refinery (including pipelines, terminals, bulk plants, wholesale purchaser-consumers, and retailers[149]) must ensure that the sulfur level of fuels supplied to the various end-users covered by today's rule complies with the requirements in today's rule. At certain points in the distribution system, such parties must keep the various grades of fuel having different sulfur specifications physically separate,[150] and ensure that the fuel is properly designated and labeled. In other words, fuel represented as 15 ppm sulfur must comply with the 15 ppm sulfur standard, and fuel represented as 500 ppm sulfur must meet the 500 ppm sulfur standard. At other points in the distribution system, certain fuels may be commingled provided that the fuel volumes are appropriately designated and accounted for in the custody holders volume account balance. Owners and operators of NRLM diesel equipment must also use fuels meeting specific sulfur content standards. The following paragraphs discuss several provisions that apply to these parties: distribution of various fuel sulfur grades; diesel fuel pump labeling; use of used motor oil in diesel fuel; use of kerosene in diesel fuel; use of additives in diesel fuel; requirements for end users; and provisions covering downgrading of undyed diesel fuel to different grades of fuel. These provisions are analogous to similar provisions that apply to highway diesel fuel under the highway program. Section IV discusses in detail the provisions applicable to downstream parties under the designate and track program.

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[149] An owner/operator of a tanker truck that delivers fuel directly from the tanker truck tank into motor vehicles or nonroad equipment of another business entity (i.e. a mobile refueler) would be acting as a retailer, and the truck would be operating as a retail outlet. In other words, the term retail outlet is not limited to stationary facilities. EPA proposed specific textual changes to the definition of retail outlet to clarify this, but has decided there is no need to change the definition, as it has always had this plain meaning. The owner/operator of such a tanker truck may also be subject to distributor requirements and prohibitions, or carrier responsibilities if the trucker company does not take title to the fuel. As the definitions in 40 CFR 80.2 make clear, it is the functions performed by the owner/operator that determine whether they come within the scope of the applicable definitions, and the resulting obligations or requirements that apply. Mobile refuelers are not subject to the labeling requirements applicable to other retailers but are required to provide PTDs to their customers.

[150] For example: Once the required marker is added to heating oil at the terminal, heating oil must be segregated from all other fuel grades. Once red dye is added to NRLM it must be segregated from highway diesel fuel.

1. Product Segregation and End Use Requirements

The main requirements for compliance with the fuel sulfur standards under today's rule, including the designate and track provisions, are discussed in section IV of today's preamble. The sulfur content of all fuels subject to the sulfur requirements in today's rule must be appropriately represented (designated/classified/labeled) at all times through to the retailer or wholesale purchaser consumer. Furthermore, the designation and classification information on the label and PTD, and the actual sulfur content of any subject fuel must be consistent with the requirements detailed in section IV. Section IV also details how to accurately redesignate, reclassify, and re-label fuel volumes. This subsection discusses the various grades and uses of NRLM fuel under the NRLM diesel program. In later subsections, we discuss related requirements for PTDs to identify fuels throughout the distribution system and provisions relating to the liability that all parties in the distribution face for failing to maintain the standards of these different fuel sulfur grades.

a. The Period From June 1, 2007 through May 31, 2010

From June 1, 2007 through May 31, 2010, all fuel used in NRLM equipment must meet a 500 ppm sulfur standard except for fuel produced or imported under the hardship, small refiner, and credit provisions.[151] Outside of the Northeast/Mid-Atlantic Area and Alaska, we will not be able to rely upon the measurement of sulfur content alone to enforce the segregation requirements for heating oil, and are therefore requiring that heating oil be marked before it leaves the terminal by the addition of 6 mg/L of SY-124. Fuel containing more than 0.1 mg/L of the marker will be deemed to be heating oil and may not be used as nonroad, locomotive or marine fuel.

NRLM fuel designated or labeled as 500 ppm sulfur must meet the 500 ppm sulfur standard and any fuel designated or labeled as 15 ppm must meet the 15 ppm sulfur standard.[152] If a fuel meeting these standards is mixed or contaminated with a higher sulfur fuel it must be downgraded to the higher sulfur product and new documentation (e.g., PTD, label) must be created to reflect the downgrade. During this period there will also be nonroad equipment that is expected to be equipped with sulfur sensitive emissions control technology that needs to operate on 500 ppm sulfur or less fuel in order to meet the NRLM program's emission standards in-use. Fuels sold for use in, or dispensed into, these engines must be identified as meeting the 15 ppm sulfur standard or the 500 ppm sulfur standard, as applicable, and if so identified must meet such standard. Distributors and retailers must avoid contaminating fuel represented by them on PTDs or pump labels as 15 ppm sulfur fuel or 500 ppm sulfur fuel with higher sulfur fuels. End users

[151] Fuel produced in the distribution system that meets a 500 ppm sulfur specification may be used in NRLM equipment through June 1, 2014, and in locomotive and marine equipment thereafter.

[152] This requirement becomes effective June 1, 2006 to support the anti-downgrade requirements in the highway diesel rule.

are required to use only the fuel grades identified as appropriate for use on the label affixed to their NRLM equipment.

b. The Period From June 1, 2010 through May 31, 2012

Beginning June 1, 2010, all fuel used in nonroad equipment must meet a 15 ppm sulfur standard except for 500 ppm sulfur fuel produced or imported under the hardship, small refiner, and credit provisions, or downstream flexibility provisions which may continue to be used in nonroad engines produced prior to 2011. Locomotive and marine fuel will continue to be subject to the sulfur requirements applicable beginning June 1, 2007, until May 31, 2012.

During this time period, we will not be able to rely upon the measurement of sulfur content alone to enforce the segregation requirements for LM fuel and NR 500 ppm sulfur fuel outside of the Northeast/Mid-Atlantic Area and Alaska, and are therefore requiring that LM fuel produced or imported for use outside of the Northeast/Mid-Atlantic Area and Alaska be marked before it leaves the terminal by the addition of 6 mg/L of SY-124. Fuel containing more than 0.1 mg/L of the marker will be deemed to be either LM fuel or heating oil and may not be used as nonroad fuel. Fuel containing the marker that meets a 500 ppm sulfur standard will be deemed to be LM fuel, whereas fuel containing the marker with a sulfur content above 500 ppm will be deemed to be heating oil.

As discussed in section IV above, small refiners will be able to continue to produce 500 ppm sulfur nonroad fuel, through May 31, 2014. Other refiners may use credits through May 31, 2014 to continue to produce fuel to the 500 ppm sulfur nonroad diesel fuel standard. Nonroad diesel fuel meeting a 500 ppm sulfur standard may also be produced due to interface mixing in the distribution system.[153] In any case, 15 ppm sulfur diesel fuel must be segregated from 500 ppm sulfur NRLM diesel fuel throughout the distribution system including the end user, such that it maintains its designation, or it must be redesignated and labeled to its downgraded specification.[154]

Because of the sulfur sensitivity of the expected engine emission control systems beginning in model year 2011 for nonroad diesel engines, it is imperative that the distribution system segregate nonroad diesel fuel subject to the 15 ppm sulfur standard from higher sulfur distillate products, such as 500 ppm sulfur LM fuel, 500 ppm sulfur nonroad diesel fuel produced by small refiners or through the use of credits, heating oil, and jet fuel. End users are required to

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[153] Such 500 ppm sulfur downstream flexibility nonroad diesel fuel may be also be used in LM equipment since it complies with the LM sulfur standard applicable during this time period. Thus, both marked and unmarked 500 ppm sulfur fuel may be used in LM equipment during this time period.

[154] These flexibilities do not exist in the Northeast/Mid-Atlantic Area, and only the small refiner option exists in Alaska.

use only the fuel grades identified as appropriate for use on the label affixed to their NR and LM equipment.

We are also concerned about potential misfueling of engines requiring 15 ppm sulfur fuel at retail or wholesale purchaser-consumer facilities (as defined under this program), or other end-user facilities, even when segregation of 15 ppm sulfur fuel from the higher-sulfur grades of diesel fuel has been maintained in the distribution system. Thus, downstream compliance and enforcement provisions of this rule are aimed at both preventing contamination of nonroad diesel fuel subject to the 15 ppm sulfur standard (i.e., fuel represented to meet that standard) and preventing misfueling of new nonroad equipment.

c. The Period From June 1, 2012 through May 31, 2014

Beginning June 1, 2012, all fuel used in locomotive and marine equipment must meet a 15 ppm sulfur standard except for 500 ppm sulfur fuel produced or imported under the hardship, small refiner, and credit provisions, or downstream flexibility provisions. As discussed in section IV above, small refiners will be able to continue to produce 500 ppm sulfur LM fuel, through May 31, 2014. Other refiners may use credits through May 31, 2014 to continue to produce fuel to the 500 ppm sulfur LM diesel fuel standard. Locomotive, and marine diesel fuel meeting a 500 ppm sulfur standard may also be produced due to interface mixing in the distribution system indefinitely.

The marker requirement for 500 ppm sulfur LM diesel fuel expires on June 1, 2012. After June 1, 2012, only heating oil must continue to be marked and any LM diesel fuel distributed from the terminal must not contain the marker. To allow marked LM diesel fuel distributed prior to June 1, 2012 to be consumed by end-users, the downstream prohibition against LM fuel containing the marker will not become effective until October 1, 2012. Beginning October 1, 2012, LM diesel fuel at any location must contain no more that 0.1 mg/L of the marker.[155] We believe that allowing four months for downstream parties to blend down their stocks of marked LM diesel fuel with receipts of unmarked LM diesel fuel will be sufficient for such parties to comply with the prohibition against possessing LM fuel with a marker concentration greater than 0.1 mg/L.

The requirements that became effective for fuel used in nonroad equipment on June 1, 2010, will remain effective until May 31, 2014.

[155] Allowing four months for the LM fuel distribution system to sufficiently purge itself of marked fuel is consistent with the time allowed for LM diesel fuel to comply with a 500 ppm sulfur standard after the refinery gate 15 ppm sulfur standard for LM fuel becomes effective.

d. After May 31, 2014

After the small refiner, credit, and off-specification fuel flexibilites have expired, the remaining sulfur grades of diesel fuel will be 15 ppm sulfur highway and NRLM fuel, 500 ppm sulfur LM diesel fuel (produced due to interface mixing in the distribution system outside of the Northeast/Mid-Atlantic Area and Alaska), and heating oil, some of which may meet a 500 ppm sulfur standard. Product transfer documents are required to accompany the batches of such fuels which must contain the specified identifying information. Highway and NRLM diesel fuel meeting a 15 ppm sulfur specification must be segregated from 500 ppm sulfur LM diesel fuel, and heating oil. Today's rule contains provisions for the fungible shipment of LM diesel fuel with any heating oil meeting a 500 ppm sulfur cap up to the point where the fuel leaves the terminal that are similar to the provisions that allow the fungible shipment of high sulfur NRLM diesel fuel and high sulfur heating oil discussed in the previous section. Under such circumstances the designate and track and heating oil account balance requirements must be satisfied.

2. Diesel Fuel Pump Labeling to Discourage Misfueling

For any multiple-fuel program like the two-step program we are finalizing today, we believe that the clear labeling of nonroad diesel fuel pumps is vital so that end users can readily distinguish between the several grades of fuel that may be available at fueling facilities, and properly fuel their nonroad equipment. Section III.N above describes the labels that manufacturers are required to place on nonroad equipment, and the information that must be provided to nonroad equipment owners. Section VI discusses the likely benefit for many nonroad engines to utilize 500 ppm sulfur diesel fuel as soon as it becomes available in 2007. Today's final rule includes requirements for labeling fuel pump stands used to fuel NRLM equipment and highway diesel vehicles.

To help prevent misfueling of nonroad, locomotive and marine engines, and to thus ensure that the environmental benefits of the program are realized, we are finalizing pump labeling requirements similar to those adopted in the highway diesel rule (40 CFR § 80.570). Today's pump dispenser labeling requirements are discussed separately according to the date they become effective: June 1, 2006, June 1, 2007, June 1, 2010, and June 1, 2014.

Today's final rule also amends the pump dispenser labeling language in the highway diesel regulations for consistency with the NRLM program. Because existing highway diesel regulations prohibit highway diesel fuel with sulfur levels above 500 ppm, the highway diesel final rule and this program have different meanings for the terms "low sulfur" and "high sulfur," and the highway diesel final rule does not use the term "ultra low-sulfur." Further, because the highway diesel final rule did not need to categorize the different uses of non-highway diesel fuel, the highway diesel final rule and this program have different meanings for the term "nonroad." [156]

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[156] In the highway diesel rule, the term "high-sulfur" means diesel fuel with a sulfur level greater than 15 ppm, whereas in this rule it means diesel fuel with a sulfur level greater than 500 ppm. In the

The amendments to the highway pump dispenser labeling language finalized by today's rule are meant to avoid confusion at the fuel pumps caused by labels that would have different meanings depending on whether the pump is dispensing highway or non-highway diesel fuel. Today's final rule adds effective dates to each paragraph of the labeling provisions of the highway diesel rule for consistency with the additional pump labeling sections of this program, and to distinguish the non-highway labeling requirement effective June 1, 2006 under the highway diesel rule from the non-highway labeling requirements of this rule that are effective in 2007.

Alternate labels to those specified in today's rule may be used if they are approved by the Administrator.

Today's rule also finalizes labeling requirements for pumps in Alaska that dispense NRLM diesel fuel and heating oil which is exempt from the red dye and fuel marker requirements which differ from the labeling requirements discussed in this section. Please refer to §69.52(e) of the regulatory text to today's rule for these pump labeling requirements applicable in Alaska.

a. Pump Labeling Requirements that Become Effective June 1, 2006

The pump labeling requirements described in this section become effective June 1, 2006.

i. Pumps Dispensing Highway Diesel Fuel Subject to the 15 ppm Sulfur Standard

The label on pumps dispensing highway diesel fuel subject to the 15 ppm sulfur standard must read as follows:

ULTRA LOW-SULFUR HIGHWAY DIESEL FUEL (15 ppm Sulfur Maximum)
Required for use in all model year 2007 and later highway diesel vehicles and engines.
Recommended for use in all diesel vehicles and engines.

The above labeling requirement for 15 ppm sulfur highway diesel fuel continues through May 31, 2010, after which time different pump label requirements for this fuel become effective as described in section V.C.2.c.3. of this preamble.

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highway diesel rule, the term "low-sulfur" means diesel fuel with a sulfur level less than or equal to 15 ppm, whereas in this rule it means diesel fuel with a sulfur level less than or equal to 500 ppm. In addition, the term "nonroad" as used in the highway diesel rule means "non-highway" (i.e., all fuel that is not highway fuel), but the term "nonroad" as used in this rule does not include locomotive diesel, marine diesel and heating oil.

ii. Pumps Dispensing Highway Diesel Fuel Subject to the 500 ppm Sulfur Standard

The label on pumps dispensing highway diesel fuel subject to the 500 ppm sulfur standard must read as follows:

LOW-SULFUR HIGHWAY DIESEL FUEL (500 ppm Sulfur Maximum)
WARNING
Federal law *prohibits* use in model year 2007 and later highway vehicles and engines.
Its use may damage these vehicles and engines.

Dispensing highway diesel fuel that has a sulfur content above 15 ppm is prohibited into any highway vehicle after September 30, 2010. Hence no pumps may display the above label after September 30, 2010.

iii. Pumps Dispensing Diesel Fuel for Non-Highway Equipment that Does not Meet the Standards for Motor Vehicle Diesel Fuel

The label on pumps dispensing diesel fuel for non-highway equipment that does not meet the standards for motor vehicle diesel fuel must read as follows:

NON-HIGHWAY DIESEL FUEL (May Exceed 500 ppm Sulfur)
WARNING
Federal law *prohibits* use in any highway vehicle or engine
Its use may damage these vehicles and engines.

This labeling requirement is effective until May 31, 2007, after which high sulfur non-highway diesel fuel must be labeled according to the provisions described in section V.C.2.b.iii and 500 ppm sulfur non-highway diesel fuel must be labeled according to the provisions described in section V.C.2.b.1. of today's preamble.

b. Pump Labeling Requirements that Become Effective June 1, 2007

As discussed in section IV, between June 1, 2007 and September 30, 2010, end users are not always required to dispense fuel meeting the 500 ppm sulfur standard into nonroad, equipment, locomotives or marine vessels. During this time period, small refiner fuel and fuel produced under the credit provisions with sulfur levels exceeding 500 ppm will continue to exist in the distribution system. During this time period, there will also be nonroad equipment with engines certified as meeting the Tier 4 emission standards (i.e., engines equipped with emission controls that allow them to meet the Tier 4 standards earlier than required). Some of this equipment is expected to be equipped with sulfur sensitive technology that will need to operate on fuel with a sulfur content of 500 ppm or less to function properly. For this reason, it is important that NRLM end users be able to know the sulfur level of the fuel they are purchasing and

dispensing. Therefore, fuel pump dispensers for the various sulfur grades must also be properly labeled. The following pump labeling requirements become effective from June 1, 2007:

i. Pumps Dispensing NRLM Diesel Fuel Subject to the 500 ppm Sulfur Standard

The label on pumps dispensing 500 ppm (maximum) sulfur content diesel fuel for use in NRLM engines must read as follows:

LOW-SULFUR NON-HIGHWAY DIESEL FUEL
(500 ppm Sulfur Maximum)
WARNING
Federal law *prohibits* use in any highway vehicle or engine

The above labeling requirement remains effective until May 31, 2010, after which it is superceded by the requirements described below.

ii. Pumps Dispensing NRLM Diesel Fuel Subject to the 15 ppm Sulfur Standard

It is also likely that prior to June 1, 2010 some 15 ppm sulfur (maximum) diesel fuel will be introduced into the nonroad market early. Both the engine and fuel credit provisions envision such early introduction of 2011-compliant engines and 15 ppm sulfur diesel fuel. Thus, it is important that nonroad end users be able to know when they are purchasing diesel fuel with 15 ppm or less sulfur.[157] The label on pumps dispensing 15 ppm sulfur diesel fuel for use in NRLM engines must read as follows:

ULTRA-LOW SULFUR NON-HIGHWAY DIESEL FUEL
(15 ppm Sulfur Maximum)
Required for use in all model year 2011 and newer nonroad diesel engines.
Recommended for use in all nonroad, locomotive and marine diesel engines.
WARNING
Federal law *prohibits* use in any highway vehicle or engine

The above labeling requirement continues until May 31, 2014, after which it is superceded by the labeling provisions described in section V.C.2.e.i of today's preamble.

iii. Pumps Dispensing Diesel Fuel with a Sulfur Content Greater than 500 ppm for Use in Older NRLM Equipment

The label on pumps dispensing diesel fuel having a sulfur content greater than 500 ppm (for use in older nonroad, locomotive, and marine diesel engines) must read as follows:

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[157] The IRS requires that 15 ppm sulfur non-highway diesel fuel must contain red dye after it leaves the terminal.

HIGH-SULFUR NON-HIGHWAY DIESEL FUEL
(May Exceed 500 ppm Sulfur)
WARNING
Federal law *prohibits* use in highway vehicles or engines
May damage nonroad, diesel engines required to use low-sulfur or ultra-low sulfur diesel fuel.

The above labeling requirement remains effective until Sept 30, 2010. After Sept 30, 2010 no pump may display this label.

iv. Pumps Dispensing Heating Oil

As discussed in section IV.B.2.b, it is necessary to segregate heating oil from NRLM diesel fuel to ensure that the fuel used in nonroad, locomotive, and marine equipment is compliant with the sulfur standards in today's rule. The label on pumps dispensing non-highway diesel fuel for use other than in nonroad, locomotive or marine engines, such as for use in stationary diesel engines or as heating oil, must read as follows:

HEATING OIL (May Exceed 500 ppm Sulfur)
WARNING
Federal law *prohibits* use in highway vehicles or engines,
or in nonroad, locomotive, or marine engines.
Its use may damage these diesel engines.

The above labeling will remain effective indefinitely.

c. Pump Labeling Requirements that Become Effective June 1, 2010

Beginning October 1, 2010, all diesel fuel introduced into highway diesel vehicles, regardless of the year of manufacture, must meet the 15 ppm sulfur standard. Furthermore, with certain exceptions, fuel introduced into any nonroad engine must meet the 15 ppm sulfur standard. The exceptions are fuel allowed to meet the 500 ppm sulfur standard for use only in pre-model year 2011 nonroad engines and locomotive and marine engines, for example, small refiner nonroad diesel fuel and credit nonroad diesel fuel, as well as downgraded 15 ppm sulfur diesel fuel from the distribution system. This use of 500 ppm sulfur diesel fuel in nonroad engines will continue through September 30, 2014,[158] after which all nonroad diesel fuel must meet the 15 ppm sulfur standard. The following pump labeling requirements become effective June 1, 2010:

[158] Production of 500 ppm sulfur fuel under the credit provisions is allowed until June 1, 2012, but small refiner fuel subject to the 500 ppm sulfur standard can continue to be produced until June 1, 2014 and will be available to end users until September 1, 2014.

i. Pumps Dispensing NRLM Diesel Fuel Subject to the 500 ppm Sulfur Standard

The label on pumps dispensing 500 ppm (maximum) nonroad, locomotive, and marine diesel fuel, as discussed in section IV.B.3.b, must read as follows:

LOW-SULFUR NON-HIGHWAY DIESEL FUEL
(500 ppm Sulfur Maximum)
WARNING
Federal law *prohibits* use in all model year 2011 and newer nonroad engines.
May damage model year 2011 and newer nonroad engines.
Federal Law P*rohibits* Use in any Highway Vehicle or Engine.
Recommended for use in all locomotive and marine equipment.

The above labeling requirement remains effective until September 30, 2014. After September 30, 2014, no pump may display this label.

ii. *Pumps Dispensing Marked LM fuel*

The label on pumps dispensing 500 ppm sulfur locomotive, and marine diesel fuel, as discussed in section IV.B.3.b., must read as follows:

LOW-SULFUR LOCOMOTIVE AND MARINE DIESEL FUEL
(500 ppm Sulfur Maximum)
WARNING
Federal law *prohibits* use in nonroad engines or in highway vehicles or engines.

The above labeling requirement remains effective until September 30, 2012. After September 30, 2012, no pump may display this label.

iii. Pumps Dispensing Highway Diesel Fuel Subject to the 15 ppm Sulfur Standard

The label on pumps dispensing highway diesel fuel subject to the 15 ppm sulfur standard of § 80.520(a)(1) must read as follows:

ULTRA LOW-SULFUR HIGHWAY DIESEL FUEL (15 ppm Sulfur Maximum)
Required for use in all highway diesel vehicles and engines.
Recommended for use in all diesel vehicles and engines.

The above labeling requirement for 15 ppm sulfur highway diesel fuel continues indefinitely.

d. Pump Labeling Requirements that Become Effective June 1, 2014

Beginning October 1, 2014, all nonroad fuel distributed to end-users is required to meet the 15 ppm sulfur standard, without exception. Locomotive and marine fuel downstream of the refinery or importer is still subject to the 500 ppm sulfur standard. The pump labels for heating oil will continue to be the same as for the period 2010 through 2014. The following pump labeling requirements become effective beginning June 1, 2014:

i. Pumps Dispensing NRLM Diesel Fuel Subject to the 15 ppm Sulfur Standard

For pumps dispensing nonroad diesel fuel the label must read as follows:

ULTRA-LOW SULFUR NON-HIGHWAY DIESEL FUEL
(15 ppm Sulfur Maximum)
Required for use in all nonroad diesel engines.
Recommended for use in all locomotive and marine diesel engines.
WARNING
Federal law *prohibits* use in any highway vehicle or engine.

The above labeling requirement continues indefinitely.

ii. Pumps Dispensing Locomotive and Marine Diesel Fuel Subject to the 500 ppm Sulfur Standard

For pumps dispensing locomotive or marine diesel fuel, the label must read as follows:

LOW-SULFUR LOCOMOTIVE OR MARINE DIESEL FUEL
(500 ppm Sulfur Maximum)
WARNING
Federal law *prohibits* use in nonroad engines or in highway vehicles or engines.
Its use may damage these engines.

The above labeling requirement will remain effective indefinitely.

f. Nozzle Size Requirements or other Requirements to Prevent Misfueling

Like the highway diesel fuel program, the NRLM diesel fuel program does not include a nozzle size requirement. In part this is because we are not aware of an effective and practicable scheme to prevent misfueling through the use of different nozzle sizes or shapes, and in part because we do not believe that improper fueling will be a significant enough problem to warrant such an action. In the preamble to the highway diesel fuel rule, we stated our belief that the use of unique nozzles, color-coded scuff-guards, or dyes to distinguish the grades of diesel fuel may be useful in preventing accidental use of the wrong fuel. (See 66 FR 5119, January 18, 2001.) However, we did not finalize any such requirements, for the reasons described in the RIA for that final rule (section IV.E).

Similar reasoning applies to the NRLM diesel fuel program. For example, 15 ppm sulfur diesel fuel will be the dominant fuel in the market by 2010, likely comprising more than 80 percent of all number 2 distillate. Further, we believe that 500 ppm sulfur diesel fuel will have limited availability between 2010 and 2014. High-sulfur distillate for heating oil uses will remain, but will only exist in significant volumes in certain parts of the country. In addition, as with highway diesel engines, there is currently no standardization of fuel tank openings and filler necks that would allow for a simple, inexpensive, standardization of nozzles. In any event, we believe that most owners and operators of new nonroad diesel engines and equipment will not risk voiding the general warranty and the emissions warranty by misfueling.

Although in the highway diesel fuel rule we did not finalize any provisions beyond fuel pump labeling requirements, we recognized that some potential for misfueling could still exist. Consequently, we expressed a desire to continue to explore with industry simple, cost-effective approaches that could further minimize misfueling potential such as color-coded nozzles/scuff guards. Since the highway diesel rule was promulgated, we have had discussions with fuel retailers, wholesale purchaser-consumers, vehicle manufacturers, and nozzle manufacturers, and continue to examine different methods for preventing accidental or intentional misfueling under the highway diesel fuel sulfur program. To date, the affected stakeholders, including engine and truck manufacturers, truck operators, fuel retailers, and fuel nozzle manufacturers have not reached any common view that the concerns over misfueling warrant any additional prevention measures.

3. Prohibition Against the Use of Used Motor Oil in New Nonroad Diesel Equipment

We understand that used motor oil is sometimes blended with diesel fuel today for use as fuel in nonroad diesel equipment. Such practices include blending used motor oil directly into the equipment fuel tank, blending it into the fuel storage tanks, and blending small amounts of motor oil from the engine crank case into the fuel system as the equipment is operated.

However, motor oil normally contains high levels of sulfur. Thus, the addition of used motor oil to nonroad diesel fuel could substantially impair the sulfur-sensitive emissions control equipment expected to be used by engine manufacturers to meet the emissions standards in today's final rule. Depending on how the oil is blended, it could increase the sulfur content of the fuel by as much as 200 ppm sulfur. As a result, we believe blending used motor oil into nonroad diesel fuel could render inoperative the expected emission control technology and potentially cause driveability problems. Consequently, it would violate the tampering prohibition in the Act. See CAA sections 203(a)(3), and 213(d).

Therefore, like the highway diesel rule, today's rule prohibits any person from introducing or causing or allowing the introduction of used motor oil, or diesel fuel containing used motor oil, into the fuel delivery systems of nonroad equipment engines manufactured in model year 2011 and later. The only exception to this will be where the engine was explicitly certified to the emission standard with used motor oil added and the oil was added in a manner consistent with

the certification. Furthermore, as discussed in section IV, today's rule includes certain sunset dates when all NRLM diesel fuel in the distribution system must meet the applicable sulfur standard, and before that date any NRLM designated, classified, or labeled as 15 ppm sulfur fuel must meet that sulfur standard. Blending of used motor oil into NRLM could cause these standards to be exceeded in violation of today's rule. Any party who causes the sulfur content of nonroad diesel fuel subject to the 15 ppm sulfur standard to exceed 15 ppm by blending motor oil into nonroad diesel fuel, or by using motor oil as nonroad diesel fuel, is subject to liability for violating the sulfur standard. Similarly, parties who cause the sulfur level of nonroad diesel fuel subject to the 500 ppm sulfur nonroad diesel fuel standard to exceed that standard by blending motor oil into the fuel, are also be subject to liability.

4. Use of Kerosene in Diesel Fuel

As we discussed in the highway diesel final rule, kerosene is commonly added to diesel fuel to reduce fuel viscosity in cold weather (see 66 FR 5120, January 18, 2001). This final rule does not limit this practice with regard to 15 ppm sulfur or 500 ppm sulfur NRLM diesel fuel. However the resulting blend will still be subject to the 15 ppm sulfur or 500 ppm sulfur standard. Kerosene that is used, intended for use, or made available for use as, or for blending with, 15 ppm sulfur or 500 ppm sulfur diesel fuel is itself required to meet the 15 ppm sulfur or 500 ppm sulfur standard.

As a general matter, any party who blends kerosene, or any blendstock, into NRLM diesel fuel, or who produces NRLM diesel fuel by mixing blendstocks, will be treated as a refiner and will be subject to the requirements and prohibitions applicable to refiners under today's rule. For example, the fuel that they manufacture must meet the sulfur standards established in this rule, and represented on the PTD. However, in deference to the longstanding and widespread practice of blending kerosene into diesel fuel at downstream locations, downstream parties who only blend kerosene into NRLM and highway diesel fuel will not be subject to the requirements applicable to other refiners, provided that they do not alter the fuel in any other way, and do not violate the volume balance requirements discussed in section IV.D. For example, they will not need to meet the 80/20 requirements under the highway diesel program. This activity is treated the same way under the final highway diesel rule. Parties that blend kerosene into diesel fuel are subject to the downstream designate and track provisions applicable to other downstream parties.

In order to ensure the continued compliance of 15 ppm sulfur fuel with the 15 ppm sulfur standard, downstream parties choosing to blend kerosene into 15 ppm sulfur NRLM diesel fuel are required to either have a PTD for that kerosene indicating compliance with the 15 ppm sulfur standard, or to have test results for the kerosene establishing such compliance. Further, downstream parties choosing to blend kerosene into 15 ppm sulfur NRLM diesel fuel are entitled to the two ppm adjustment factor discussed in section V.D.2. for both the kerosene and the diesel fuel into which it is blended at downstream locations, provided that the kerosene had been transferred to the party with a PTD indicating compliance with that standard. Sulfur test results from downstream locations of parties who do not have such a PTD for their kerosene will not be

subject to this adjustment factor, either for the kerosene itself, or for the NRLM diesel fuel into which it is blended.

Any party who causes the sulfur content of NRLM diesel fuel represented as meeting the 15 ppm sulfur standard to exceed 15 ppm sulfur by blending kerosene into NRLM diesel fuel, or by using greater than 15 ppm sulfur kerosene as NRLM diesel fuel, is subject to liability for violating the sulfur standard. Similarly, parties who cause the sulfur level of NRLM diesel fuel subject to the 500 ppm sulfur diesel fuel standard to exceed that standard by blending kerosene into the fuel, are also be subject to liability.

Today's rule does not require refiners or importers of kerosene to produce or import kerosene meeting the 15 ppm sulfur standard. However, we believe that refiners will produce ultra low sulfur kerosene in the same refinery processes that they use to produce ultra low sulfur diesel fuel, and that the market will drive supply of ultra low sulfur kerosene for those areas where, and during those seasons when, the product is needed for blending with NRLM, as well a highway, diesel fuel.

As discussed in section IV.D, kerosene blending also factors into the designate and track provisions finalized today from June 1, 2006 until June 1, 2010. During this time period it is possible, and in fact likely, that kerosene meeting the 15 ppm sulfur standard will instead be designated as No. 1 highway diesel fuel, and will simply need to meet all of the requirements of highway diesel fuel. It is also possible, though less likely that kerosene meeting the 500 ppm sulfur standard will be designated as No. 1 highway diesel fuel. However, if it is, it would also merely need to comply with all the requirements applicable to highway diesel fuel.

5. Use of Diesel Fuel Additives

Diesel fuel additives include lubricity improvers, corrosion inhibitors, cold-operability improvers, and static dissipaters. Use of such additives is distinguished from the use of kerosene or biodiesel by the low concentrations at which they are used (defined to be one percent or less) and their relatively more complex chemistry.[159] The suitability of diesel fuel additives for use in diesel fuel meeting a 500 ppm sulfur specification has been well established due to the existence of 500 ppm sulfur highway diesel fuel in the marketplace since 1993. The suitability of additives for use in 15 ppm sulfur diesel fuel was first addressed by EPA in the highway diesel program, which requires highway diesel fuel to meet a 15 ppm sulfur standard beginning in 2006. At the time of the finalization of the highway diesel final rule and during our development of the proposed NRLM diesel rule, our review of data submitted by additive and fuel manufacturers to

[159] Diesel fuel additives are used at concentrations commonly expressed in parts per million. Diesel fuel additives can include specially-formulated polymers and other complex chemical components. Kerosene is used at much higher concentrations, expressed in volume percent. Unlike diesel fuel additives, kerosene is a narrow distillation fraction of the range of hydrocarbons normally contained in diesel fuel.

comply with EPA's Fuel and Fuel Additive Registration requirements indicated that additives to meet every purpose, including static dissipation, are currently in common use which meet a 15 ppm cap on sulfur content.[160]

a. Additives Used in 15 ppm Sulfur Diesel Fuel

Similar to the highway diesel rule, today's rule allows the bulk addition of diesel fuel additives with a sulfur content greater than 15 ppm in NRLM diesel fuel under certain circumstances.[161] However, NRLM diesel fuel containing such additives will continue to be subject to the 15 ppm sulfur cap. We believe that it is most appropriate for the market to determine how best to accommodate increases in fuel sulfur content from the refinery gate to the end user, while maintaining the 15 ppm sulfur cap, and whether such increases result from contamination in the distribution system or bulk diesel additive use. By providing this flexibility, we anticipate that market forces will encourage an optimal balance between the competing demands of manufacturing fuel lower than the 15 ppm sulfur cap, limiting contamination in the distribution system, and limiting the bulk additive contribution to fuel sulfur content.

Thus, as in the highway diesel program, additive manufacturers that market bulk diesel additives with a sulfur content higher than 15 ppm and blenders that use them in nonroad diesel have additional requirements to ensure that the 15 ppm sulfur cap for NRLM diesel fuel is not exceeded.

The 15 ppm sulfur cap on highway diesel fuel that becomes effective in 2006 may encourage the gradual retirement of additives that do not meet a 15 ppm sulfur cap. The 15 ppm sulfur cap for NR fuel in 2010 and for LM fuel in 2012 may further this trend. However, we do not anticipate that this will result in disruption to additive users and producers or a significant increase in cost. Additive manufacturers commonly reformulate their additives on a periodic basis as a result of competitive pressures. We anticipate that any reformulation that might need to occur to meet a 15 ppm sulfur cap, will be accomplished prior to the implementation of the 15 ppm sulfur cap on highway diesel fuel in 2006.

Like the highway diesel fuel rule, this rule will limit the continued use in 15 ppm sulfur fuel of a bulk additive that exceeds 15 ppm sulfur to a concentration of less than one volume

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[160] See Chapter IV.D. of the RIA for the highway diesel fuel rule for more information on diesel fuel additives, EPA Air docket A-99-06, docket item V-B-01. Also See 40 CFR part 79.

[161] Most diesel fuel additives are added at the terminal to bulk fuel volumes before sale to the consumer. These additives are referred to as bulk additives. End users and wholesale purchaser consumers sometimes also add additives to diesel fuel by hand blending into the vehicle fuel tank or fleet fuel storage tanks. Such additives are referred to as aftermarket additives. As discussed at the end of this section, today's rule contains different requirements regarding the use of aftermarket additives.

percent. We believe that this limitation is appropriate and will not cause any undue burden because the diesel fuel additives for which this flexibility was included are always used today at concentrations well below one volume percent. Further, one volume percent is the threshold above which the blender of an additive becomes subject to all the requirements applicable to a refiner. See 40 CFR §79.2(d)(1) and 40 CFR part 80.

The specific requirements regarding the use of bulk diesel fuel additives in NRLM fuel subject to the 15 ppm sulfur standard are as follows:

- Bulk additives that have a sulfur content at or below 15 ppm must be accompanied by a PTD that states: "The sulfur content of this additive does not exceed 15 ppm."

- Bulk additives that exceed 15 ppm sulfur could continue to be used in diesel fuel subject to the 15 ppm sulfur standard provided that they are used at a concentration of less than one volume percent and their transfer is accompanied by a PTD that lists the following:
    1) a warning that the additive's sulfur content may exceed 15 ppm and that improper use of the additive may result in non-complying fuel
    2) the additive's maximum sulfur concentration
    3) the maximum recommended concentration for use of the additive in diesel fuel, and
    4) the contribution to the sulfur level of the fuel that would result if the additive is used at the maximum recommended concentration.

We proposed that the affirmative defenses to presumptive liability for blenders of bulk additives with a sulfur content greater than 15 ppm must include periodic sulfur tests after the addition of the additive showing that the finished fuel does not exceed the 15 ppm sulfur cap. We are adopting this proposed requirement for additives other than static dissipater additives.

b. Static Dissipater Additives

Comments from diesel fuel distributors and additive manufactures stated that static dissipater additives are unique among the various types of diesel fuel additives in that there are currently none available with a sulfur content below 15 ppm which are fully effective. Considering the lack of static dissipater additives meeting a 15 ppm sulfur cap, and the inability to add static dissipater (S-D) additives prior to shipment by pipeline, commenters stated that the prohibitive cost of testing fuel batches after the addition of static dissipater additives could discourage their use. To avoid the potential adverse impact on the safety of the fuel distribution industry which could result, commenters requested that we provide an alternative method for use in demonstrating their affirmative defense to presumptive liability when they use static dissipater additives with a sulfur content above 15 ppm. Manufacturers of static dissipater additives stated that due to very low treatment rates that are needed for such additives, their use will raise the sulfur content of the finished fuel by no more than 0.02 ppm. Commenters stated that because of

the extremely low potential contribution to the sulfur level of the finished diesel fuel which might result from the use of static dissipater additives, there was little risk that use of such additives would result in noncompliance with the 15 ppm sulfur cap.

We contacted all of the additive manufactures that have registered static dissipater additives in EPA's Fuel and Fuel Additive Database.[162] All of these manufactures stated that there are no fully-effective static dissipater additives available that have a sulfur content below 15 ppm. They further stated that sulfur is an essential component in static dissipater additives, and that it is currently unclear how to formulate a static dissipater additive that would have a sulfur content below 15 ppm. Because of this input, we now recognize that static dissipater additives are in a unique category with respect to the ability to comply with a 15 ppm sulfur cap. Additive manufactures stated that reformulation of static dissipater additives to meet a 15 ppm sulfur cap will likely be a lengthy undertaking.

It is unclear which of the naturally-occurring components in diesel fuel act to dissipate static electricity. However, certain batches of fuel are periodically found which do not have adequate static dissipating qualities. In such cases, static dissipater additives are necessary to prevent a static discharge from occurring during the transfer of fuel into a storage tank which might cause an explosion. Therefore, it is essential that today's rule is structured in such a way so as to not impede the use static dissipater additives. Because of the lack of static dissipater additives meeting a 15 ppm sulfur specification, the unique difficulty in reformulating them to meet a 15 ppm sulfur standard, the fact that they are essential to the safety of the fuel distribution system, and the impracticability for them to be added at the refinery, today's rule includes special affirmative defense provisions to reduce the sulfur testing burden associated with the use of static dissipater additives that have a sulfur content greater than 15 ppm.

Commenters suggested an alternative mechanism to demonstrate an affirmative defense to presumptive liability for blenders of static-dissipater (S-D) additives which would avoid the need to test every batch of fuel at the terminal after additization. Under this approach, blenders of S-D additives would be required to provide volume accounting reconciliation (VAR) records similar to those under EPA's deposit control additive rule (40 CFR part 80, subpart G) which would show whether the S-D additive is being added at the appropriate rate on average over a course of a monthly accounting period. Today's rule finalizes the approach suggested by commenters with certain modifications. In cases where a violation of the 15 ppm sulfur cap for diesel fuel is discovered on a batch of fuel downstream of a blender of S-D additives that have a sulfur content above 15 ppm, the S-D additive blender must provide the following information to EPA in order to meet their affirmative defense to presumptive liability regarding the potential that the use of S-D additive might have caused or contributed to the violation:

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[162] All additives must be registered with EPA Fuel and Fuel Additive Database prior to their use in motor vehicle diesel fuel.

- A sulfur test on the diesel batch prior to the addition of the S-D additive package that indicates that the additive, when added, will not cause the fuel to exceed 15 ppm
- A product transfer document that accompanied the transfer of the S-D additive package to the additive blender which contains the following:
  - A statement that the S-D additive package exceeds 15 ppm in sulfur content and that special requirements apply if it is to be used in diesel fuel subject to the 15 ppm sulfur cap
  - The maximum sulfur level of the S-D additive package including other additive components such as diesel detergents and carrier fluid to the extent that they are part of the package. Each component of the additive package other than the S-D additive itself must comply with the 15 ppm sulfur cap.
  - The maximum recommended concentration for the S-D additive package.
  - The contribution to the final sulfur content of a finished fuel when the additive is added at the maximum recommended concentration. The maximum recommended concentration must result in a potential increase in the sulfur content of the finished fuel of no more than 0.05 ppm.
- Monthly volume accounting reconciliation (VAR) records that include:
  - the amount of S-D additive package used during the month
  - the volume of the fuel into which the additive was injected during the month
  - the measured sulfur level of each fuel batch prior to injection of the additive which shows that the contribution to the sulfur level of the finished diesel fuel from the use of the additive at the treatment level at which it was injected would not cause any such batch of fuel to exceed the 15 ppm sulfur specification
- Quality assurance records which show that the precision of the additive injection equipment has been maintained in such a manner as to prevent malfunctions which could result in the injection of the S-D additive at a higher concentration than that reported.

The additive blender must also be able to meet its normal diesel fuel defense elements: that the additive blender-fuel distributor did not cause the violation; that PTDs account for all the fuel and show apparent compliance; and that quality assurance sampling and testing has occurred, as modified by the discussion above.

In addition, the ratio of the amount of additive used to the amount of fuel into which the additive was injected over any given monthly VAR period must not exceed the maximum treatment rate which could be added to any batch of fuel additized during the period. If not, the blender could be liable for any batch of diesel fuel found that exceeded the 15 ppm sulfur cap which had been in their possession. The above provisions are only relevant for establishing affirmative defense to presumptive liability regarding the potential that the use of S-D additives might have caused a violation. Under no circumstances may an additive blender cause the sulfur level of any batch of finished fuel to exceed the 15 ppm sulfur cap. Blenders of S-D additives must meet all other requirements for distributors of 15 ppm sulfur diesel fuel. Regardless of the cause of a violation of the 15 ppm sulfur standard, any party that had custody or title of off-specification fuel is potentially liable and responsible for their affirmative defense elements.

These provisions may only be used for static dissipater additives which have the potential to raise the sulfur content of the finished fuel by no more than 0.050 ppm when used at their maximum recommended treatment level. Based on the input from additive manufacturers noted above, this will allow the use of S-D additives that are fully effective for this purpose. The use of S-D additives that might have a higher contribution to the sulfur content of the finished fuel, therefore, is unnecessary. To establish affirmative defense to presumptive liability, blenders that use S-D additives that could contribute more than 0.050 ppm to the sulfur content of a finished fuel subject to the 15 ppm sulfur specification when used at the maximum recommended treatment level are required to conduct a sulfur test on the fuel batch after the addition of the additive. Blenders of additives other than S-D additives which have a sulfur content greater than 15 ppm into diesel fuel subject to the 15 ppm sulfur standard are also required to conduct a sulfur test on the fuel batch after the addition of the additive for affirmative defense purposes.

EPA may require additive manufactures to supply samples of the additive packages (or the components additives in such packages) that are used in 15 ppm sulfur diesel fuel, or may sample from additive batches already in the distribution system. In such cases, we may test the sulfur content of these additives to evaluate whether they are in compliance with the information provided on the PTDs or other relevant documentation. In cases where a violation is discovered, any party in the distribution system that had custody of the additive batch found to be in violation may be held presumptively liable for the violation.

Today's rule amends the highway diesel regulation so that the provisions finalized today regarding the use of S-D additives with a sulfur content above 15 ppm in NRLM diesel fuel also apply to the use of such additives in highway diesel fuel subject to a 15 ppm sulfur standard. However, we continue to be concerned about the use of additives having a sulfur content greater than 15 ppm. We will continue to monitor this issue and may initiate an additional rulemaking in the future to consider further limiting or prohibiting the use of greater than15 ppm sulfur additives in diesel fuel subject to a 15 ppm sulfur cap.

The special provisions for static-dissipater additives finalized in today's rule will ensure that the unique challenges regarding the manufacture and use of such additives do not present a barrier to their continued use. Additive manufactures have stated that they are working on reformulation of their S-D additives to meet a 15 ppm sulfur limit.

We recently learned that industry is beginning to develop a standardized test to quantify the concentration of static-dissipater additives in finished fuel.[163] If such a test were available, it might be useful for establishing an additive blender's affirmative defense to presumptive liability in place of some of the VAR provisions described above. If a batch of fuel was found to exceed the 15 ppm sulfur cap, the use of such a test would allow for the measurement of the contribution to the sulfur level of the finished fuel which resulted from the addition of the static dissipater additive. If the contribution was below the permissible level given the sulfur measurements on

[163] Phone conversation with Eon McMullen, Octel additives, February 12, 2004.

each batch of fuel additized with the greater than15 ppm S-D additive, it might be useful in association with other blender records to demonstrate that the additive blender was not at fault for the violation. If such a standardized test becomes available, EPA will work with the appropriate industry parties to evaluate its applicability for affirmative defense purposes, and conduct a rulemaking if appropriate to amend the elements required to establish affirmative defense to presumptive liability under the NRLM and highway diesel programs.

c. Additives Used in 500 ppm Sulfur Diesel Fuel

The 1993 and 2007 highway diesel programs did not contain any requirements regarding the maximum sulfur content of additives used in highway diesel fuel subject to a 500 ppm sulfur cap.[164] Our experience under the highway program indicates that application of the 500 ppm sulfur cap throughout the distribution system to the end-user has been sufficient to prevent the use of additives from jeopardizing compliance with the 500 ppm sulfur standard. The potential increase of several ppm in the sulfur content of diesel fuel which might result from the use of some diesel additives raises substantial concerns regarding the impact on compliance with a 15 ppm sulfur cap. However, this is not the case with respect to the potential impact on compliance with a 500 ppm sulfur cap. The current average sulfur content of highway diesel fuel of 340 ppm provides ample margin for the minimal increase in the fuel sulfur content which might result from the use of additives. We expect that this will also be the case for NRLM fuel subject to the 500 ppm sulfur standard. Therefore, we are not finalizing any requirements regarding the sulfur content of additives used in NRLM fuel subject to the 500 ppm sulfur standard. We believe that the requirement that NRLM fuel comply with a 500 ppm sulfur cap throughout the distribution system to the end-user will be sufficient to ensure that entities who introduce additives into such fuel take into account the potential increase in fuel sulfur content.

d. Aftermarket Additives

We believe that more stringent requirements are needed for aftermarket additives than for bulk additives due to the lack of practical safeguards to ensure that the use of such additives do not cause a violation of the sulfur standards in today's rule. Also, the presence of multiple grades of aftermarket additives, some suitable for use in engines equipped with sulfur sensitive emissions control equipment as well as pre-control engines, and some suitable for use only in pre-control engines would raise significant concerns regarding the misuse. The misuse of a high sulfur additive in an engine with sulfur sensitive emissions control equipment could damage this equipment. Therefore, today's rule requires that all aftermarket additives sold for use in nonroad, locomotive, and marine equipment must meet a 500 ppm sulfur cap beginning June 1, 2007, and

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[164] The 500 ppm sulfur highway diesel final rule contains the requirement that highway diesel fuel not exceed 500 ppm sulfur at any point in the fuel distribution system including after the blending of additives. Fuel Quality Regulations for Highway Diesel Fuel Sold in 1993 and Later Calendar Years, Final Rule, 55 FR 34120, August 21, 1990.

that all aftermarket additives sold for use in nonroad equipment must meet a 15 ppm sulfur specification beginning June 1, 2010. After June 1, 2010, aftermarket additives with a sulfur content less than 500 ppm may continue to be used in locomotive and marine engines. This approach is consistent with that taken in the highway diesel rule which requires all aftermarket additives to meet a 15 ppm sulfur specification beginning June 1, 2006.

6. End User Requirements

In light of the importance of ensuring that the proper fuel is used in nonroad, locomotive, and marine engines covered by this program, any person is prohibited from fueling such an engine with fuel not meeting the applicable sulfur standard.

Specifically:
1) No person may introduce, or permit the introduction of fuel containing the heating oil marker into nonroad, locomotive, marine or highway diesel engines;

2) No person may introduce, or permit the introduction of, fuel that exceeds 15 ppm sulfur content into nonroad equipment with a model year 2011 or later engine;

3) Beginning December 1, 2010, no person may introduce, or permit the introduction of any fuel exceeding 500 ppm sulfur content into any nonroad, locomotive, and marine engine; and

4) Beginning December 1, 2014, no person may introduce, or permit the introduction of any fuel exceeding 15 ppm sulfur content into any nonroad diesel engine regardless of year of manufacture.

D. Diesel Fuel Sulfur Sampling and Testing Requirements

1. Testing Requirements

Today's action provides a new approach for fuel sulfur measurement. The details of this approach are described below, followed by a description of who will be required to conduct fuel sulfur testing as well as what fuel must be tested. The diesel fuel sulfur sampling and testing provisions described below are similar to those that were proposed. Adjustments we made to the proposed provisions were in response to comments we received during the public comment period.

a. Test Method Approval, Record-keeping, and Quality Control Requirements

Most current and past EPA fuel programs designated specific analytical methods which refiners, importers, and downstream parties[165] use to analyze fuel samples at all points in the fuel distribution system for regulatory compliance purposes. Some of these programs have also allowed certain specific alternative methods which may be used as long as the test results are correlated to the designated test method. The highway diesel rule (66 FR 5002, January 18, 2001), for example, specifies one designated test method and three alternative methods for measuring the sulfur content of highway diesel fuel subject to the 15 ppm sulfur standard. The rule also specifies one designated method and three alternative methods for measuring the sulfur content of highway diesel fuel subject to the 500 ppm sulfur standard.

[165] Other EPA fuels regulations have allowed downstream parties conducting periodic quality assurance testing for defense purposes to use methods other than the designated method, so long as the method is an ASTM method appropriate for testing for the applicable fuel property, and so long as the instrument is correlated to the designated method.

Table V.H-1. – Designated and Alternative Sulfur Test Methods Allowed Under the Highway Diesel Program

Sulfur Test Method	500 ppm	15 ppm
ASTM D 2622-03, as modified, *Standard Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry*	Designated	Alternative
ASTM D 3120-03a, *Standard Test Method for Trace Quantities of Sulfur in Light Liquid Petroleum Hydrocarbons by Oxidative Microcoulometry*		Alternative
ASTM D 4294-03, *Standard Test Method for Sulfur in Petroleum and Petroleum Products by Energy-Dispersive X-ray Fluorescence Spectrometry*	Alternative	
ASTM D 5453-03a, *Standard Test Method for Determination of Total Sulfur in Light Hydrocarbons, Motor Fuels and Motor Oils by Ultraviolet Fluorescence*	Alternative	Alternative
ASTM D 6428-99, *Test Method for Total Sulfur in Liquid Aromatic Hydrocarbons and Their Derivatives by Oxidative Combustion and Electrochemical Detection.*	Alternative	Designated

The highway diesel fuel rule also announced the Agency's intention to adopt a performance-based test method approach in the future, as well as our intention to continue working with the industry to develop and improve sulfur test methods. Today's action adopts such a performance-based test method approach for both highway and NRLM diesel fuel subject to the 15 ppm and 500 ppm sulfur standards. In addition, the current approach for measuring the sulfur content of diesel fuel subject to the 500 ppm sulfur standard, i.e., using the designated sulfur test method or one of the alternative test methods with correlation will remain applicable.

Under the performance-based approach, a given test method can be approved for use in a specific laboratory by meeting certain precision and accuracy criteria specified in the regulations. The method can be approved for use by that laboratory as long as appropriate quality control procedures are followed. Properly selected precision and accuracy values allow multiple methods and multiple commercially available instruments to be approved, thus providing greater flexibility in method and instrument selection while also encouraging the development and use of better

methods and instrumentation in the future. Under today's rule, there is no designated sulfur test method as specified under previous regulations.

Since any test method that meets the specified performance criteria may qualify, this type of approach does not conflict with the "National Technology Transfer and Advancement Act of 1995" (NTTAA), section 12(d) of Public Law 104-113, and the Office of Management and Budget (OMB) Circular A -119. Both of these are designed to encourage the adoption of standards developed by "voluntary consensus standards bodies" (VCSB)[166] and to reduce reliance on government-unique standards where such consensus standards would suffice. Under the performance criteria approach in today's rule, methods developed by consensus bodies as well as methods not yet approved by a consensus body qualify for approval provided they meet the specified performance criteria as well as the record-keeping and reporting requirements for quality control purposes.

i. How Can a Given Method be Approved?

A given test method can be approved for use under today's program by meeting certain precision and accuracy criteria. Approval applies on a laboratory/facility-specific basis. If a company chooses to employ more than one laboratory for fuel sulfur testing purposes, then each laboratory must separately seek approval for each method it intends to use. Likewise, if a laboratory chooses to use more than one sulfur test method, then each method must be approved separately. Separate approval is not necessary for individual operators or laboratory instruments within a given laboratory facility.

The specific precision and accuracy criteria were derived from existing sulfur test methods that are either required or allowed under the highway diesel fuel sulfur program. The first criterion, precision, refers to the consistency of a set of measurements and is used to determine how closely analytical results can be duplicated based on repeat measurements of the same material under prescribed conditions. To demonstrate the precision of a given sulfur test method under the performance-based approach, a laboratory facility must perform 20 repeat tests over 20 days on samples taken from a homogeneous supply of a commercially available diesel fuel. Based on the comments we received on this issue, we are also clarifying that the test results must in general be a sequential record of the analyses with no omissions. A laboratory facility may exclude a given sample or test result only if 1) the exclusion is for a valid reason under good laboratory practices and 2) it maintains records regarding the sample and test results and the reason for excluding them. Using the test results[167] of ASTM D 3120 for diesel fuel subject to the

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[166] These are standard-setting organizations, like ASTM, and ISO that have broad representation of all interested stakeholders and make decisions by consensus.

[167] Sulfur Repeatability of Diesel by Method at 15 ppm, ASTM Report on Low Level Sulfur Determination in Gasoline and Diesel Interlaboratory Study - A Status Report, June 2002.

15 ppm sulfur standard, the precision must be less than 0.72 ppm.[168] Similarly, using the test results of ASTM D 2622 for diesel fuel subject to the 500 ppm sulfur standard, the precision must be less than 9.68 ppm.

The second criterion, accuracy, refers to the closeness of agreement between a measured or calculated value and the actual or specified value. To demonstrate the accuracy of a given test method under the performance-based approach, a laboratory facility is required to perform 10 repeat tests on a standard sample, the mean of which for diesel fuel subject to the 15 ppm sulfur standard can not deviate from the Accepted Reference Value (ARV) of the standard by more than 0.54 ppm and for diesel fuel subject to the 500 ppm sulfur standard can not deviate from the ARV of the standard by more than 7.26 ppm[169]. These tests must be performed using commercially available gravimetric sulfur standards. Ten tests are required using each of two different sulfur standards. For 15 ppm fuel, one must be in the range of 1–10 ppm sulfur and the other in the range of 10–20 ppm sulfur. For 500 ppm fuel, one must be in the range of 100–200 ppm sulfur and the other in the range of 400–500 ppm sulfur for 500 ppm sulfur diesel fuel. Therefore, a minimum of 20 total tests is required for sufficient demonstration of accuracy for a given sulfur test method at a given laboratory facility. As with the requirement for precision demonstration described above, the test results must be a sequential record of the analyses with no omissions. Finally, any known interferences for a given test method must be mitigated.

Some commenters remarked that the ARV of the standards does not account for any uncertainty given that all commercially available standards have an uncertainty associated with

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[168] 0.72 ppm is equal to 1.5 times the standard deviation of ASTM D 3120, where the standard deviation is equal to the repeatability of ASTM D 3120 (1.33) divided by 2.77. 9.68 ppm is equal to 1.5 times the standard deviation of ASTM D 2622, where the standard deviation is equal to the repeatability of ASTM D 2622 (17.88) divided by 2.77. In the proposal, we stated that the repeatability of ASTM D 2622 was 26.81. While that reported value was incorrect due to either a typographical or a computational error, the resulting precision value that we are finalizing today was correctly calculated and reported as 9.68 ppm. The "sample standard deviation" should be used for this purpose. By its use of N-1 in the denominator, this measure applies a correction for the small sample bias and provides an unbiased estimate of the standard deviation of the larger population from which the sample was drawn. Since the conditions of the precision qualification test admit more sources of variability than the conditions under which ASTM repeatability is determined (longer time span, different operators, environmental conditions, etc.) the repeatability standard deviation derived from the round robin was multiplied by what we believe to be a reasonable adjustment factor, 1.5, to compensate for the difference in conditions.

[169] 0.54 and 7.26 are equal to 0.75 times the precision values of 0.72 for 15 ppm sulfur diesel and 9.68 for 500 ppm sulfur diesel, respectively.

the certified value. The commenters added that EPA should specify what maximum value in the uncertainty associated with the ARV is allowed.

These requirements are not intended be overly burdensome. Indeed, we believe these requirements are equivalent to what a laboratory would do during the normal start up procedure for a given test method. In addition, we believe this approach will allow regulated entities to know that they are measuring diesel fuel sulfur levels accurately and within reasonable site reproducibility limits.

ii. What Information Must Be Reported to the Agency?

For test methods that have already been approved by a VCSB, such as ASTM or the International Standards Organization (ISO), each laboratory facility must report to the Agency the precision and accuracy results as described above for each method for which it is seeking approval. Such submissions to EPA, as described elsewhere, are subject to the Agency's review for 90 days, and the method will be considered approved in the absence of EPA comment. Laboratory facilities are required to retain the fuel samples used for precision and accuracy demonstration for 90 days. While we proposed a 30 day sample retention period, commenters stated that the sample retention period for fuel samples that are used for precision and accuracy demonstrations should be equivalent to the length of EPA's review period (i.e., 90 days). We agree with the commenters and are thus finalizing a 90 day sample retention period in today's rule. This sample retention requirement also applies to non-VCSB methods which are described below.

For test methods that have not been approved by a VCSB, full test method documentation, including a description of the technology/instrumentation that makes the method functional, as well as subsequent EPA approval of the method is also required. These submissions will also be subject to the Agency's review for 90 days, and the method will be considered approved in the absence of EPA comment. Submission of VCSB methods is not required since they are available in the public domain. In addition, industry and the Agency will likely have had substantial experience with such methods.

As described above, federal government and EPA policy is to use standards developed by voluntary consensus bodies when available. The purpose of the NTTAA, at least in part, is to foster consistency in regulatory requirements, to take advantage of the collective industry wisdom and wide-spread technical evaluation required before a test method is approved by a consensus body, and to take advantage of the ongoing oversight and evaluation of a test method by the consensus body that results from wide-spread use of an approved method e.g., the ongoing round-robin type analysis and typical annual updating of the method by the consensus body. These goals are not met where the Agency allows use of a non-consensus body test method in perpetuity. Moreover, it is not possible to realize many of the advantages that result from consensus status where a test method is used by only one or a few companies. It will not have the practical scrutiny that comes from ongoing wide-spread use, or the independent scrutiny of the consensus body and

periodic updating. In addition, EPA does not have the resources to conduct the degree of initial scrutiny or ongoing scrutiny that are practiced by consensus bodies. Nevertheless, EPA believes it is appropriate to allow limited use of a proprietary test method for a limited time, even though the significant advantages of consensus test methods are absent, because EPA can evaluate the initial quality of a method and a company may have invested significant resources in developing a method. However, if after a reasonable time a test method fails to gain consensus body approval, EPA believes approval of the method should be withdrawn because of the absence of ongoing consensus oversight. Accordingly, a non-VCSB method will cease to be qualified five years from the date of its original approval by EPA in the absence of VCSB approval.

To assist the Agency in determining the performance of a given sulfur test method, non-VCSB methods, in particular, we reserve the right to send samples of commercially available fuel to laboratories for evaluation. Such samples are intended for situations in which the Agency has concerns regarding a test method and, in particular, its ability to measure the sulfur content of a random commercially available diesel fuel. Laboratory facilities are required to report their results from tests of this material to the Agency.

iii. What Quality Control Provisions are Required?

We are requiring ongoing Quality Control (QC) procedures for sulfur measurement instrumentation. These are procedures used by laboratory facilities to ensure that the test methods they have qualified and the instruments on which the methods are run are yielding results with appropriate accuracy and precision, e.g., that the results from a particular instrument do not "drift" over time to yield unacceptable values. It is our understanding that most laboratories already employ QC procedures, and that these are commonly viewed as important good laboratory practices. Laboratories will be required, at a minimum, to abide by the following QC procedures for each instrument used to test batches of diesel fuel under these regulations even where a laboratory elects to use the test method used to establish the precision and accuracy criteria finalized in today's rule:

1) Follow the mandatory provisions of ASTM D 6299-02, *Standard Practice for Applying Statistical Quality Assurance Techniques to Evaluate Analytical Measurement System Performance*. Laboratories are required to construct control charts from the mandatory QC sample testing prescribed in paragraph 7.1, following the guidelines under A 1.5.1 for individual observation charts and A 1.5.2 for moving range charts.

2) Follow ASTM D 6299-02 paragraph 7.3.1 (check standards) using a standard reference material. Check standard testing is required to occur at least monthly and should take place following any major change to the laboratory equipment or test procedure. Any deviation from the accepted reference value of the check standard greater than 1.44 ppm for diesel fuel subject to the 15 ppm sulfur standard and

19.36 ppm for diesel fuel subject to the 500 ppm sulfur standard[170] must be investigated.

3) Upon discovery of any QC testing violation of A 1.5.2.1 or A 1.5.3.2 or check standard deviation greater than 1.44 ppm and 19.36 ppm for 15 ppm sulfur diesel and 500 ppm sulfur diesel, respectively, as provided in item 2 above, any measurement made while the system was out of control must be tagged as suspect and an investigation conducted into the reasons for this anomalous performance. Refiners and importers are required to retain batch samples for 30 days or the period equal to the interval between QC sample tests, whichever is longer. If an instrument is found to be out of control, all of the retained samples since the last time the instrument was shown to be in control must be retested.

4) QC records, including investigations under item 3 above must be retained for five years and must be provided to the Agency upon request.

b. Requirements to Conduct Fuel Sulfur Testing

Given the importance of assuring that NRLM diesel fuel designated to meet the 15 ppm sulfur standard in fact meets that standard, we are requiring that refiners, importers, and transmix processors test each batch of NRLM diesel fuel designated to meet the 15 ppm sulfur standard and maintain records of such testing. Requiring that refiners, importers, and transmix processors test each batch of fuel subject to the 15 ppm sulfur NRLM standard assures that compliance can be confirmed through testing records, and even more importantly, assures that diesel fuel exceeding the 15 ppm standard is not introduced into commerce as fuel for use in nonroad equipment having sulfur-sensitive emission control devices. Batch testing was not required under the highway diesel fuel rule. Instead, such testing was expected to be performed to establish a defense to potential liability. However, for the same reasons discussed above, today's rule extends this batch testing requirement to15 ppm sulfur highway diesel fuel beginning in 2006.

In order to address situations where refiners produce NRLM diesel fuel using computer-controlled inline blending equipment and do not have storage tanks from which to withdraw samples, we are including in today's final rule a provision to allow refiners to test a composited sample of a batch of diesel fuel for its sulfur content after the diesel fuel has been shipped from the refinery. This inline blending provision is similar to the provision that exists under the reformulated gasoline and gasoline sulfur programs and applies to both highway and NRLM diesel fuel under today's action.

Today's rule does not require downstream parties to conduct every-batch testing. However, we believe that most downstream parties will voluntarily conduct "periodic" sampling

[170] 1.44 ppm is equal to two times the precision value of 0.72 ppm for 15 ppm diesel and 19.36 is equal to two times the precision value of 9.68 ppm for 500 ppm diesel.

and testing for quality assurance purposes if they want to establish a defense to presumptive liability, as discussed in section V.H. below.

2. Two Part-Per-Million Downstream Sulfur Measurement Adjustment

We believe that it is appropriate to recognize sulfur test variability in determining compliance with the 15 ppm sulfur NRLM diesel fuel standards downstream of a refinery or import facility. Thus, today's rule provides that for all 15 ppm sulfur NRLM diesel fuel at locations downstream of a refinery or import facility, sulfur test results can be adjusted by subtracting two ppm. In the same manner as finalized for 15 ppm sulfur highway diesel fuel, the sole purpose of this downstream compliance provision is to address test variability concerns (see the highway diesel fuel rule). We received comments suggesting that a higher downstream test tolerance is needed based on the current values for test method variability. However, we anticipate that the reproducibility of sulfur test methods is likely to improve to two ppm or even less by the time the 15 ppm sulfur standard for highway diesel fuel is implemented – four years before implementation date of the 15 ppm standard for NRLM diesel fuel. With this provision, we anticipate that refiners will be able to produce diesel fuel with an average sulfur level of approximately 7-8 ppm and some contamination could occur throughout the distribution system, without fear of causing a downstream violation due solely to test variability. As test methods improve in the future, we will reevaluate whether two ppm is the appropriate allowance for purposes of this compliance provision. We also received comments that a test tolerance should be provided in determining compliance with the 500 ppm sulfur standards for NRLM fuel. We believe that such a tolerance is not needed for fuels subject to a 500 ppm sulfur standard because of the flexibility that refiners possess to produce fuel with a sufficiently low sulfur content to accommodate test variability.

3. Sampling Requirements

Today's rule adopts the same sampling methods adopted by the highway diesel rule (66 FR 5002, January 18, 2001). These sampling methods are American Society for Testing and Materials (ASTM) D 4057-95 (manual sampling) and D 4177-95 (automatic sampling from pipelines/in-line blending). The requirement to use these methods becomes effective for NRLM diesel fuel on June 1, 2007. These same methods were also adopted for use in the Tier 2/Gasoline Sulfur rule.[171]

4. Alternative Sampling and Testing Requirements for Importers of Diesel Fuel Who Transport Diesel Fuel by Tanker Truck

We understand that importers who transport diesel fuel into the U.S. by tanker truck are frequently relatively small businesses that could be subject to a substantial burden if they were

[171] 65 FR 6833-34 (Feb. 10, 2000). Today's rule also provides that these methods be used under the RFG and CG rules. See 62 FR 37337 *et seq*. (July 11, 1997).

required to sample and test each batch of NRLM or highway diesel fuel imported by truck, especially where a trucker imports many small loads of diesel fuel. Therefore, today's rule provides that truck importers may comply with an alternative sampling and testing requirement, involving a sampling and testing program of the foreign truck loading terminal, if certain conditions are met. For an importer to be eligible for the alternative sampling and testing requirement, the terminal must conduct sampling and testing of the NRLM or highway diesel fuel immediately after each receipt into its terminal storage tank but before loading product into the importer's tanker truck storage compartments or immediately prior to loading product into the importer's tanker truck if it hasn't tested after each receipt. Moreover, the importer will be required to conduct periodic quality assurance testing of the terminal's diesel fuel, and the importer will be required to assure EPA that we will be allowed to make unannounced inspections and audits, to sample and test fuel at the foreign terminal facility, to assure that the terminal maintained sampling and testing records, and to submit such records to EPA upon request.

E. Selection of the Marker for Heating Oil

As discussed in section IV.D, to ensure that heating oil is not shifted into the NRLM market, we need a way to distinguish heating oil from high sulfur or 500 ppm sulfur NRLM diesel fuel produced under the small refiner and credit provisions in today's rule. Currently, there is no differentiation today between fuel used for NRLM uses and heating oil. Both are typically produced to the same sulfur specification, and both are required to have the same red dye added prior to distribution from downstream of the terminal. Based on recommendations from refiners, in the NPRM, we concluded that the best approach to differentiate heating oil from NRLM diesel fuel would be to require that a marker be added to heating oil at the refinery gate. Since the proposal we received additional information which allows us to rely upon record-keeping and reporting provisions to differentiate heating oil from NRLM up to the point where it leaves the terminal (see section IV.D). Therefore, today's rule requires that a marker be added to heating oil before it leaves the terminal gate rather than the refinery gate as proposed.[172]

Section IV.D of today's preamble also discusses the need to distinguish 500 ppm sulfur locomotive and marine fuel produced by refiners and imported from 2010–2012 from 500 ppm sulfur nonroad diesel fuel produced during this time frame under the small refiner, credit, and downstream flexibility provisions in today's rule. Without this ability, it would be possible for 500 ppm sulfur LM diesel fuel to be shifted into the nonroad market during this time period outside of the Northeast/Mid-Atlantic Area and Alaska. Therefore, today's rule requires that from June 1, 2010 through May 31, 2012, the same marker added to heating oil must also be added to 500 ppm sulfur LM diesel fuel produced by a refiner or imported for use outside of the Northeast/Mid-Atlantic Area and Alaska before the fuel leaves the terminal. Nonroad diesel fuel meeting a 500 ppm sulfur standard produced under the small refiner or credit provisions, and 500 ppm sulfur NRLM diesel fuel generated under the downstream flexibility provisions in today's

[172] Heating oil sold inside the Northeast/Mid-Atlantic Area adopted under today's rule and Alaska does not need to contain a marker (see section IV.D.).

rule could be sold into the LM market outside of the Northeast/Mid-Atlantic Area and Alaska. Such 500 ppm sulfur NRLM diesel fuel does not need to be marked. Therefore, both marked and unmarked 500 ppm sulfur diesel fuel could be used in locomotive and marine diesel equipment outside of the Northeast/Mid-Atlantic Area and Alaska from 2010 through 2012.[173]

As discussed in section IV.D., use of the same marker in heating oil and 500 ppm sulfur LM fuel is feasible because the underlying goal is the same, i.e., keeping 500 ppm sulfur diesel fuel produced as heating oil or LM fuel from begin shifted into the nonroad diesel market from 2010 through 2012. We will be able to determine whether heating oil with a sulfur content greater than 500 ppm has been shifted into the LM market downstream of the terminal by testing the sulfur content of LM. 500 ppm fuel initially designated as heating oil can be later shifted into the LM market, since the sulfur standard for LM diesel fuel during this period is 500 ppm.

Terminal operators suggested that we might be able to rely on record-keeping and reporting downstream of the terminal as well as above the terminal level, thereby eliminating any need for a fuel marker. However, we believe such record-keeping and reporting mechanisms would be insufficient to keep heating oil out of the NRLM market and 500 ppm sulfur LM fuel produced by a refiner or imported out of the nonroad market downstream of the terminal under typical circumstances. We can rely on such measures before the fuel leaves the terminal because it is feasible to require all of the facilities in the distribution system to report to EPA on their fuel transfers. As discussed in section IV.D., these electronic reports can be compared by EPA to identify parties responsible for shifting heating oil into the NRLM market from 2007 - 2014, 500 ppm sulfur LM fuel into the nonroad market from 2010 - 2012, and heating oil into the LM market beginning 2014. Downstream of the terminal the parties involved in the fuel distribution system become far too numerous for such a system to be implemented and enforced (including jobbers, bulk plant operators, heating oil dealers, retailers, and even end-users with storage tanks such as farmers. Reporting errors for even a small fraction would require too many resources to track down and correct and would eliminate the effectiveness of the system.

Our proposal envisioned that a fuel marker would be required in heating oil from June 1, 2006 through May 31, 2010, and that the same marker would be required in locomotive and marine fuel from June 1, 2010 through May 31, 2014. As a consequence of finalizing the 15 ppm sulfur standard for locomotive and marine fuel in 2012, we no longer need to require that LM diesel fuel be marked after June 1, 2012. The 2010-2012 marking requirement for 500 ppm sulfur LM diesel fuel does not apply to 500 ppm sulfur LM fuel produced by a refiner or imported in the Northeast/Mid-Atlantic Area or in Alaska. There is an ongoing need to require the continued use of the marker in heating oil indefinitely (see section IV of today's preamble).

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[173] Inside the Northeast/Mid-Atlantic Area, 500 ppm sulfur fuel produced from transmix or segregated interface could be sold into the LM or heating oil markets from 2010-2012, and could only be sold into the heating oil market after 2012. Outside of the Northeast/Mid-Atlantic Area, such fuel could be sold into the NRLM market from 2010 - 2012, and into the LM market thereafter.

We proposed that beginning June 1, 2007 SY-124 must be added to heating oil in the U.S. at a concentration of 6 milligrams per liter (mg/L). Today's rule adopts this requirement except for heating oil used in the Northeast/Mid-Atlantic Area and Alaska.[174] The chemical composition of SY-124 is as follows: N-ethyl-N-[2-[1-(2-methylpropoxy)ethoxyl]-4-phenylazo]-benzeneamine.[175] This concentration is sufficient to ensure detection of SY-124 in the distribution system, even if diluted by a factor of 50. Any fuel found with a marker concentration of 0.1 milligrams per liter or more will be presumed to be heating oil. Below this level, the prohibition on use in highway, nonroad, locomotive, or marine applications would not apply.

There are a number of other types of dyes and markers. Visible dyes are most common, are inexpensive, and are easily detected. Using a second dye in addition to the red dye required by IRS in all non-highway fuel for segregation of heating oil based on visual identification raises certain challenges. The marker that we require in heating oil and 500 ppm sulfur LM diesel fuel must be different from the red dye currently required by IRS and EPA and not interfere with the identification of red dye in distillate fuels. Invisible markers are beginning to see more use in branded fuels and are somewhat more expensive than visible markers. Such markers are detected either by the addition of a chemical reagent or by their fluorescence when subjected to near-infra-red or ultraviolet light. Some chemical-based detection methods are suitable for use in the field. Others must be conducted in the laboratory due to the complexity of the detection process or concerns regarding the toxicity of the reagents used to reveal the presence of the marker. Near-infra-red and ultra-violet flourescent markers can be easily detected in the field using a small device and after brief training of the operator. There are also more exotic markers available such as those based on immunoassay, and isotopic or molecular enhancement. Such markers typically need to be detected by laboratory analysis.

We selected SY-124, however, for a number of reasons:

1) There is considerable data and experience with it which indicates there are no significant issues with its use;
2) It is compatible with the existing red dye;
3) Test methods exist to quantify its concentration, even if diluted by a factor of 50 to one;
4) It is reasonably inexpensive; and
5) It can be produced and provided by a number of sources.

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[174] See section IV.D of today's preamble for a discussion of the provisions for the Northeast/Mid-Atlantic Area and Alaska.

[175] Opinion on Selection of a Community-wide Mineral Oils Marking System, ("Euromarker"), European Union Scientific Committee for Toxicity, Ecotoxicity and the Environment plenary meeting, September 28, 1999.

Effective in August 2002, the European Union (EU) enacted the requirement that SY-124 be added at 6 mg/L to diesel fuel that is taxed at a lower rate in all EU member states.[176] Solvent yellow 124 is referred to as the "Euromarker" in the EU. The EU has found this treatment rate to be sufficient for their enforcement purposes while not interfering with the identification of the various different colored dyes required by different EU member states (including the same red dye that is required in the U.S.). Despite its name, SY-124 does not impart a strong color to diesel fuel when used at a concentration of 6 mg/L. Most often it is reportedly nearly invisible in distillate fuel given that the slight yellow color imparted is similar to the natural color of many distillate fuels.[177] In the presence of red dye, SY-124 can impart a slight orange tinge to the fuel. However, it does not interfere with the visual identification of the presence of red dye or the quantification of the concentration of red dye in distillate fuel. Thus, the use of SY-124 at 6 mg/L in diesel fuel would not interfere with the use of the red dye by IRS to identify non-taxed fuels.

Solvent yellow 124 is chemically similar to other additives used in gasoline and diesel fuel, and has been registered by EPA as a fuel additive under 40 CFR part 79. Therefore, we expect that its products of combustion would not have an adverse impact on emission control devices, such as a catalytic converter. Extensive evaluation and testing of SY-124 was conducted by the European Commission. This included combustion testing which showed no detectable difference between the emissions from marked and unmarked fuel. Norway specifically evaluated the use of distillate fuel containing SY-124 for heating purposes and determined that the presence of the Euromarker did not cause an increase in harmful emissions from heating equipment. Based on the European experience with SY-124, we do not expect that there would be concerns regarding the compatibility of SY-124 in the U.S. fuel distribution system or for use in motor vehicle engines and other equipment such as in residential furnaces.

Our evaluation of the process conducted by the EU in selecting SY-124 for use in the EU convinced us that SY-124 was also the most appropriate marker to propose for use in heating oil under today's program. We received a number of comments expressing concern about the use of SY-124 in heating oil. Based on our evaluation of these comments (summarized below and in the S&A), we continue to believe that SY-124 is the most appropriate marker to specify for use in heating oil and 500 ppm sulfur LM diesel fuel under today's rule. Therefore, today's rule requires that beginning June 1, 2007, SY-124 be added to heating oil, and that from June 1, 2010 through May 31, 2012, SY-124 be added to 500 ppm sulfur LM diesel fuel produced by a refiner or imported at a concentration of 6 mg/L before such fuel leaves the terminal except in the Northeast/Mid-Atlantic Area and Alaska.

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[176] The European Union marker legislation, 2001/574/EC, document C(2001) 1728, was published in the European Council Official Journal, L203 28.072001.

[177] The color of distillate fuel can range from near water white to a dark blackish brown but is most frequently straw colored.

The concerns regarding the use of SY-124 in heating oil primarily pertained to: the potential impact on jet engines if jet fuel were contaminated with SY-124; the potential health effects of SY-124 when used in fuel for heating purposes, particularly for unvented heaters; the potential cost impact on fuel distributors and transmix processors; and the potential conflict with IRS red dye requirements.

The American Society of Testing and Materials (ASTM), the Coordinating Research Council (CRC), and the Federal Aviation Administration (FAA) requested that we delay finalizing the selection of a specific marker for use in heating oil in today's rule. They requested that selection of a specific marker should be deferred until testing could be conducted regarding the potential impact of SY-124 on jet engines. The Air Transport Association stated that EPA should conduct an extensive study regarding the potential for contamination, determine the levels at which the marker will not pose a risk to jet engines, and seek approval of SY-124 as a jet fuel additive. Other parties including the Department of Defense (DoD) also stated that EPA should refrain from specifying a heating oil marker under today's rule until industry and other potentially affected parties can recommend an appropriate marker. Representatives of the heating oil industry stated that they were concerned that EPA had not conducted an independent review regarding the safety/suitability of SY-124 for use in heating oil.

We met and corresponded with numerous and diverse parties to evaluate the concerns expressed regarding the use of SY-124, and to determine whether it might be more appropriate to specify a different marker for use in heating oil. These parties include IRS, FAA, ASTM, CRC, various marker/dye manufacturers, European distributors of fuels containing the Euromarker, marker suppliers, and members of all segments in the U.S. fuel distribution system.

We believe that concerns related to potential jet fuel contamination have been sufficiently addressed for us to finalize the selection of SY-124 as the required heating oil marker in today's rule.[178] As discussed in section IV.D of today's preamble, changes in the structure of the fuel program finalized in today's rule from that in the proposed program have allowed us to move the point where the marker must be added from the refinery gate to the terminal. The vast majority of concerns regarding the potential for contamination of jet fuel with SY-124 pertained to the shipment of marked fuel by pipeline. All parties were in agreement that nearly all of the potential for marker contamination of jet fuel would disappear if the point of marker addition was moved to the terminal. We spoke with terminal operators, both large and small, who confirmed that they maintain strictly segregated distribution facilities for red dyed fuel and jet fuel because of jet fuel contamination concerns. The same type of segregation practices will apply to the handling of marked heating oil, marked 500 ppm sulfur LM diesel fuel, and jet fuel since the marker will only be present in heating oil and locomotive and marine fuel when red dye is also present. Therefore,

[178] See the Summary and Analysis of Comments for a more detailed discussion of our response to concerns about the possible contamination of jet fuel with the marker prescribed for use in heating oil and 500 ppm sulfur LM fuel under today's rule.

these practices will be equally effective in limiting contamination of jet fuel with SY-124. Downstream of the terminal, the only other chance for marker contamination of jet fuel pertains to bulk plant operators and jobbers that handle marked heating oil and jet fuel. For the most part, these parties also currently maintain strict segregation of the facilities used to transport jet fuel and heating oil. The one exception is that small bulk plant operators that supply small airports sometimes use the same tank truck to alternately transport jet fuel and heating oil. In such cases, they flush the tank compartment prior to transporting jet fuel to remove any residual heating oil left behind after the tank is drained. Since few, if any bulk plants handle LM fuel, it is unlikely that the same tank trucks will be used to alternately transport LM fuel and jet fuel. Thus, we expect that there will be even less chance for LM fuel containing the marker to contaminate jet fuel.

Today's rule requires that heating oil and locomotive and marine fuel which contains the marker must also contain visible evidence of red dye. Therefore, the “white bucket” test that distributors currently use to detect red dye contamination of jet fuel can also be relied upon to detect marker contamination of jet fuel. Based on the above discussion, we concluded that the required addition of the marker to heating oil and 500 ppm sulfur locomotive and marine fuel from 2010 – 2012 would not significantly increase the likelihood of jet fuel contamination, and that when such contamination might occur, it could be readily identified without the need for additional testing. Our finalization of the Northeast/Mid-Atlantic Area in (see section IV.D) also minimizes potential concerns regarding the potential that jet fuel may become contaminated with the marker, since no marker is required in this area. Furthermore, there is expected to be little heating oil used outside of the Northeast/Mid-Atlantic Area, the locomotive and marine market outside of the Northeast/Mid-Atlantic Area is limited. We anticipate that the distribution of marked LM diesel fuel will primarily be by segregated pathways, and the duration of the marker requirement for 500 ppm sulfur LM diesel fuel produced by refiners or imported for use outside of the Northeast/Mid-Atlantic Area and Alaska is only two years. On the whole, we actually expect that today’s rule will reduce the potential for jet fuel to become contaminated with the azo dyes such as the IRS-required red dye and SY-124 since visual evidence will no longer be required leaving the refinery gate in 500 ppm NRLM fuel beginning June 1, 2007, and will no longer be required in any off-highway diesel fuel beginning June 1, 2010.

This final rule requires addition of the marker at the terminal rather than the refinery gate as proposed. Based on this change, ASTM withdrew its request to delay the finalization of the marker requirements in today’s rule. However, ASTM stated that some concern remains regarding jet fuel contamination downstream of the terminal (due to the limited use of the same tank wagons to alternately transport jet fuel and heating oil discussed above). Nevertheless, ASTM related that these concerns need not delay finalization of the marker requirements in this rule. ASTM intends to support a CRC program to evaluate the compatibility of markers with jet fuel. The Federal Aviation Administration is also undertaking an effort to identify fuel markers that would be compatible for use in jet fuel. We commit to a review of the use of SY-124 in the future based on the findings of the CRC and the FAA, experience with the use of SY-124 in Europe, and future input from ASTM or other concerned parties. If alternative markers are

identified that do not raise concerns regarding the potential contamination of jet fuel, we will initiate a rulemaking to evaluate the use of one of these markers in place of SY-124.

Since the NPRM, no new information has been provided which indicates that the combustion of SY-124 in heating equipment would result in more harmful emissions than when combusted in engines, or would result in more harmful emissions than combustion of unmarked heating oil. The European experience with the use of SY-124 and the evaluation process it underwent prior to selection by the EU, provides strong support regarding the compatibility of SY 124 in the U.S. fuel distribution system, and for use in motor vehicle engines and other equipment such as in residential furnaces and nonroad, locomotive, and marine engines. We believe that concerns regarding the potential health impacts from the use of SY-124 do not present sufficient cause to delay finalization of the requirement for it's use that is contained in today's rule.

The European Union intends to review the use of SY-124 after December 2005, but may undertake the review earlier if any health and safety or environmental concerns about its use are raised. We intend to keep abreast of such activities and may initiate our own review of the use of SY-124 depending on the European Union's findings, or other relevant information. There will be nearly four years of accumulated field experience with the use of SY-124 in Europe at the time of the review by the EU and nearly 5 years by the implementation of the marker requirement under today's rule. This will provide ample time for any potential unidentified issues with SY-124 to be identified, and for us to choose a different marker if warranted.

Commenters stated that potential health concerns regarding the use of SY-124 might be exacerbated with respect to its use in unvented space heaters. Commenters further stated that there are prohibitions against the dyeing of kerosene (No. 1 diesel) used in such heaters. No information was provided to support these concerns, however, and we have no information to suggest any health concerns exist regarding the use of SY-124 in unvented heaters. Nevertheless, even if there were such concerns, today's rule will not require SY-124 to be used in the fuel used in unvented heaters. Furthermore, today's rule, does not require that SY-124 be added to kerosene. This resolves most of what concern might remain regarding this issue, since kerosene is the predominate fuel used in unvented heaters. However, the DoD stated that No. 2 diesel fuel is sometimes used in its tent heaters and expressed concern regarding the presence of SY-124 in fuel used for this purpose. We understand that to simplify the DoD fuel distribution system, it is DoD policy to use a single fuel called JP-8 for multiple purposes where practicable, including space heating. JP-8 used for such a purpose would not be subject to today's fuel marker requirement. In cases where JP-8 might not be available for space heating, DoD could avoid the use of SY-124 containing fuel by using kerosene in their space heaters.

We believe that the concerns expressed regarding the potential impact on distributors and transmix processors from the presence of SY-124 in heating oil and 500 ppm sulfur LM fuel have been addressed by moving the point of marker addition to the terminal. Terminal operators stated that they desire the flexibility to blend 500 ppm diesel fuel from 15 ppm diesel fuel and heating oil. This practice would have been prevented by the proposed addition of the marker at the

refinery gate. Under today's rule, terminal operators will have access to unmarked high sulfur fuel with which to manufacture 500 ppm diesel fuel by blending with 15 ppm diesel fuel.[179]

Transmix processors stated that the presence of a marker in transmix would limit the available markets for their reprocessed distillates. The feed material for transmix processors primarily consists of the interface mixing zone between batches of fuels that abut each other during shipment by pipeline where this mixing zone can not be cut into either of the adjacent products. If marked heating oil and locomotive and marine fuel was shipped by pipeline, the source material for transmix processors fed by pipelines that carry marked fuel could contain SY-124.[180] Transmix processors stated that it would be prohibitively expensive to segregate pipeline-generated transmix containing the marker from that which does not contain the marker prior to processing, and that they could not economically remove the marker during reprocessing. Thus, in cases where the marker would be present in a transmix processor's feed material, they would be limited to marketing their reprocessed distillate fuels into the heating oil market. Since today's final rule requires that the marker be added at the terminal gate (rather than at the refinery gate), the feed material that transmix processors receive from pipelines will not contain the marker. Hence, they will not typically need to process transmix containing the fuel marker prescribed in today's rule, and today's marker requirement is not expected to significantly alter their operations. There is little opportunity for marker contamination of fuels that are not subject to the marker requirements to occur at the terminal and further downstream. In the rare instances where this might occur, the fuel contaminated would likely also be a distillate fuel, and thus could be sold into the heating oil market without need for reprocessing.

We do not expect that the fuel marker requirements will result in the need for additional fuel storage tanks or tank trucks in the distribution system. As discussed in section VI.A of today's preamble, the implementation of the NRLM sulfur standards in today's rule is projected to result in the need for additional storage tanks and tank truck de-manifolding at a limited number of bulk plant facilities. The marker requirement does not add another criteria apart from the sulfur content of the fuel which would force additional product segregation. As discussed above, industry has expressed concern about the use of the same tank trucks to alternately transport heating oil and jet fuel. We do not expect that the addition of marker to heating oil and 500 ppm sulfur LM diesel fuel will exacerbate these concerns. However, depending on the outcome of the aforementioned CRC program, the addition of marker to heating oil may hasten the current trend to avoid the use of tank trucks to alternately transport jet fuel and heating oil. To the extent that

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[179] Terminals that manufacture 500 ppm diesel fuel by blending 15 ppm and high sulfur fuel are treated as a refiner under today's rule. They must also comply with all applicable designate and track requirements, anti-downgrading provisions, and the other applicable requirements in today's rule (see section IV.D of today's preamble).

[180] We do not expect that there will be sufficient demand for 500 ppm sulfur LM diesel fuel produced by refiners or importers to justify its shipment by pipeline after 2010.

this does occur, we do not expect that it would result in substantial additional costs since few tank truck operators currently use the same tank truck compartments to alternately transport heating oil and jet fuel.

Through our discussions with the IRS, we have confirmed that the presence of SY-124 will not interfere with enforcement of their red dye requirement.[181] Although, SY-124 may impart a slight orange tint to red-dyed diesel fuel, this will not complicate the identification of the presence of the IRS red dye. In fact, IRS has determined that the presence of SY-124 may even enhance enforcement of their fuel tax program.[182] However, as identified in the comments, the implementation of today's marker requirement for heating oil arguably may be in conflict with IRS regulations at 26 CFR § 48.4082-1(b) which state that no dye other than the IRS-specified red dye must be present in untaxed diesel fuel. IRS is evaluating what actions might be necessary to clarify that the addition of SY-124 to heating oil would not be in violation of IRS regulations.

IRS also related that they are investigating new markers for potential use either to supplement or to replace red dye under their diesel tax program which might be compatible with jet fuel. IRS stated that it might result in a reduced burden on industry if EPA were to adopt one of the markers from the family of markers that they are investigating. Given the changes to our program in today's final rule, the marker provisions will not impose a significant burden. However, if the IRS program were to develop an alternate marker that would be compatible with jet we will initiate a rulemaking to evaluate the use of one of these markers in place of SY-124 (see section VIII.H.).

Commenters also expressed concerns regarding the proprietary rights related to the manufacture and use of SY-124, and stated that EPA should adopt a nonproprietary marker if possible. The proprietary rights related to SY-124 expire several months after the implementation of the marker requirements finalized in today's rule. Therefore, we do not expect that the current proprietary rights regarding SY-124 are a significant concern. Commenters also stated that our estimated cost of SY-124 in the NPRM (0.2 cents per gallon of treated fuel) was high compared to other markers that cost hundredths of a cent per gallon. Since the proposal we have obtained more accurate information which indicates that the current cost of bulk quantities of SY-124 is approximately 0.03 cents per gallon of treated fuel (see section VI.A.). Based on conversations with various marker manufacturers, this cost is comparable to or less than other fuel markers.

F. Fuel Marker Test Method

As discussed in section V.E above, today's rule requires the use of SY-124 at a concentration of 6mg/L in heating oil beginning in 2007, and in 500 ppm sulfur LM diesel fuel

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[181] Phone conversation between Carl Dalton and Rick Stiff, IRS and Jeff Herzog and Paul Machiele, EPA, February 19, 2004.

[182] ibid.

produced by a refiner or importer from 2010 through 2012, except for such fuels that used in the Northeast/Mid-Atlantic Area and Alaska. There is currently no industry standard test procedure to quantify the presence of SY-124 in distillate fuels. The most commonly accepted method is based on the chemical extraction of the SY-124 using hydrocloric acid solution and cycloxane, and the subsequent evaluation of the extract using a visual spectrometer to determine the concentration of the marker.[183] This test is inexpensive and easy to use for field inspections. However, the test involves reagents that require some safety precautions and the small amount of fuel required in the test must be disposed of as hazardous waste. Commenters expressed concerns about the use of a test procedure which involves a hazardous reagent (hydrochloric acid) and which generates a waste product that must be disposed of as hazardous waste. Nevertheless, we continue to believe that such safety concerns are manageable here in the U.S. just as they are in Europe and that the small amount of waste generated can be handled along with other similar waste generated by the company conducting the test, and that the associated effort and costs will be negligible.

Changes made in today's final rule from the proposal will mean that few parties in industry will need to test for the marker, thereby minimizing concerns about the burden of such testing. Much of the testing for the fuel marker that was envisioned by industry was associated with detecting marker contamination in other fuels. By moving the required point of marker addition downstream to the terminal, today's rule virtually eliminates these concerns. Where such concerns continue to exist, the presence of the red dye will provide a visual means of detecting marker contamination.[184] Therefore, we expect that the instances where parties will need to test for marker contamination will be rare. Also, the Northeast/Mid-Atlantic Area provisions finalized in today's rule will exempt the vast majority of heating oil used in the U.S. from the marker requirement. Based on the above discussion, we believe that the vast majority of testing for the presence of the fuel marker that will be conducted will be that by EPA for enforcement purposes.

Similar to the approach proposed regarding the measurement of fuel sulfur content discussed in section V.H above, we are finalizing a performance-based procedure to measure the concentration of SY-124 in distillate fuel. Section V.H above describes our rationale for finalizing performance-based test procedures. Under the performance-based approach, a given test method can be approved for use in a specific laboratory or for field testing by meeting certain precision and accuracy criteria. Properly selected precision and accuracy values allow multiple methods and multiple commercially available instruments to be approved, thus providing greater flexibility in method and instrument selection while also encouraging the development and use of better methods and instrumentation in the future. For example, we are hopeful that with more time and effort a simpler test can be developed for SY-124 that can avoid the use of reagents and the generation of hazardous waste that is by product of the current commonly accepted method.

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[183] Memorandum to the docket entitled "Use of a Visible Spectrometer Based Test Method in Detecting the Presence and Determining the Concentration of Solvent Yellow 124 in Diesel Fuel."

[184] Today's rule requires that red dye be present in heating oil which contains the marker.

Under the performance criteria approach, methods developed by consensus bodies as well as methods not yet approved by a consensus body will qualify for approval provided they meet the specified performance criteria as well as the record-keeping and reporting requirements for quality control purposes. There is no designated marker test method.

1. How Can a Given Marker Test Method be Approved?

A marker test method can be approved for use under today's program by meeting certain precision and accuracy criteria. Approval will apply on a laboratory/facility-specific basis. If a company chooses to employ more than one laboratory for fuel marker testing purposes, then each laboratory will have to separately seek approval for each method it intends to use. Likewise, if a laboratory chooses to use more than one marker test method, then each method will have to be approved separately. Separate approval will not be necessary for individual operators or laboratory instruments within a given laboratory facility. The method will be approved for use by that laboratory as long as appropriate quality control procedures were followed.

In developing the precision and accuracy criteria for the sulfur test method, EPA drew upon the results of an inter-laboratory study conducted by the American Society for Testing and Materials (ASTM) to support ASTM's standardization of the sulfur test method. Unfortunately, there has not been sufficient time for industry to standardize the test procedure used to measure the concentration of SY-124 in distillate fuels or to conduct an inter-laboratory study regarding the variability of the method. Nevertheless, the European Union has been successful in implementing its marker requirement while relying on the marker test procedures which are currently available, as noted above. We used, the most commonly used marker test procedure to establish the precision and accuracy criteria on which a marker test procedure would be approved under the today's rule.[185]

There has been substantial experience in the use of this reference market test method since the August 2002 effective date of the European Union's marker requirement. However, EPA is aware of only limited summary data on the variability of the reference test method from a manufacturer of the visible spectrometer apparatus used in the testing.[186] The stated resolution of the test method from the materials provided by this equipment manufacturer is 0.1 mg/L, with a repeatability of plus or minus 0.08 mg/L and a reproducibility of plus or minus 0.2 mg/L.[187]

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[185] Memorandum to the docket entitled "Use of a Visible Spectrometer Based Test Method in Detecting the Presence and Determining the Concentration of Solvent Yellow 124 in Diesel Fuel."

[186] Technical Data on Fuel/Dye/Marker & Color Analyzers, as downloaded from the Petroleum Analyzer Company L.P. website at http://www.petroleum-analyzer.com/product/PetroSpec/lit_pspec/DTcolor.pdf.

[187] Repeatability and reproducibility are terms related to test variability. ASTM defines repeatability as the difference between successive results obtained by the same operator with the same

Given the lack of more extensive data, we have decided to use these available data as the basis of the precision and accuracy criteria for the marker test procedure under today's rule (as discussed below). EPA may initiate a review of the precision and accuracy criteria finalized in today's rule should additional test data become available.

Using a similar methodology to that employed in deriving the sulfur test procedure precision value results in a precision value for the marker test procedure of 0.043 mg/L (see section V.H).[188] However, we are concerned that the use of this precision value, because it is based on very limited data, might preclude the acceptability of test procedures that would be adequate for the intended regulatory use. In addition, the lowest measurement of marker concentration that will have relevance under the regulations is 0.1 mg per liter. Consequently, today's rule requires that the precision of a marker test procedure will need to be less than 0.1 mg/L for it to qualify.

To demonstrate the accuracy of a given test method, a laboratory facility will be required to perform 10 repeat tests, the mean of which can not deviate from the Accepted Reference Value (ARV) of the standard by more than 0.05 mg/L. We believe that this accuracy level is not overly restrictive, while being sufficiently protective considering that the lowest marker level of regulatory significance would be 0.1 mg/L. Ten tests will be required using each of two different marker standards, one in the range of 0.1 to 1 mg/L and the other in the range of 4 to 10 mg/L of SY-124. Therefore, a minimum of 20 total tests will be required for sufficient demonstration of accuracy for a given marker test method at a given laboratory facility. Finally, any known interferences for a given test method will have to be mitigated. These tests must be performed using commercially available SY-124 standards. Since the European Union's marker requirement will have been in effect for nearly 5 years by the implementation date of today's marker, we believe that such standards will be available by the implementation date for today's rule.

These requirements are not overly burdensome. To the contrary, these requirements are equivalent to what a laboratory would do during the normal start up procedure for a given test method. In addition, we believe the performance based approach finalized in today's rule will allow regulated entities to know that they are measuring fuel marker levels accurately and within reasonable site reproducibility limits.

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apparatus under constant operating conditions on identical test materials that would, in the long run, in the normal and correct operation of the test method be exceeded only in one case in 20. Reproducibility is defined by ASTM as the difference between two single and independent results obtained by different operators working in different laboratories on identical material that would, in the long run, be exceeded only in one case in twenty.

[188] See section V.H of this proposal for a discussion of the methodology used in deriving the proposed precision and accuracy values for the sulfur test method.

2. What Information Would Have To Be Reported to the Agency?

As noted above, the European Union's (EU) marker requirement will have been in effect for nearly five years prior to the effective data for the proposed marker requirements and we expect the EU requirement to continue indefinitely. Thus, we anticipate that the European testings standards community will likely have standardized a test procedure to measure the concentration of SY-124 in distillate fuels prior to the implementation of the marker requirement in today's final rule. The United States testing standards community may also enact such a standardized test procedure. To the extent that marker test methods that have already been approved by a voluntary consensus standards body[189] (VCSB), such as the International Standards Organization (ISO) or the American Society for Testing and Materials (ASTM), each laboratory facility would be required to report to the Agency the precision and accuracy results as described above for each method for which it is seeking approval. Such submissions to EPA, as described elsewhere, will be subject to the Agency's review for 30 days, and the method will be considered approved in the absence of EPA comment. Laboratory facilities are required to retain the fuel samples used for precision and accuracy demonstration for 30 days.

For test methods that have not been approved by a VCSB, full test method documentation, including a description of the technology/instrumentation that makes the method functional, as well as subsequent EPA approval of the method is also required. These submissions are subject to the Agency's review for 90 days, and the method will be considered approved in the absence of EPA comment. Submission of VCSB methods is not required since they are available in the public domain. In addition, industry and the Agency will likely have had substantial experience with such methods.

To assist the Agency in determining the performance of a given marker test method (non-VCSB methods, in particular), we reserve the right to send samples of commercially available fuel to laboratories for evaluation. Such samples are intended for situations in which the Agency has concerns regarding a test method and, in particular, its ability to measure the marker content of a random commercially available diesel fuel. Laboratory facilities are required to report the results from tests on this material to the Agency.

G. Requirements for Record-keeping, Reporting, and PTDs

1. Registration Requirements

As discussed in section IV.D, by December 31, 2005, or six months prior to handling fuels subject to the designation requirements of today's rule, each entity in the fuel distribution system, up through and including the point where fuel is loaded onto trucks for distribution to retailers or wholesale purchaser-consumers, must register each of its facilities with EPA.

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[189] These are standard-setting organizations, like ASTM, and ISO that have broad representation of all interested stakeholders and make decisions by consensus.

An entity's registration must include the following information:

- Corporate name and address
  - Contact name, telephone number, and e-mail address
- For each facility operated by the entity:
  - Type of facility (e.g. refinery, import facility, pipeline, terminal)
  - Facility name
  - Physical location
  - Contact name, telephone number, and e-mail address

2. Applications for Small Refiner Status

An application of a refiner for small refiner status must be submitted to EPA by December 31, 2004 and shall include the following information:

- The name and address of each location at which any employee of the company, including any parent companies, subsidiaries, or joint venture partners[190] worked From January 1, 2002 until January 1, 2003;

- The average number of employees at each location, based on the number of employees for each of the company's pay periods from January 1, 2002 until January 1, 2003;

- The type of business activities carried out at each location; and

- The total crude oil refining capacity of the corporation. We define total capacity as the sum of all individual refinery capacities for multiple-refinery companies, including any and all subsidiaries, and joint venture partners as reported to the Energy Information Administration (EIA) for 2002, or in the case of foreign refiners, a comparable reputable source, such as professional publication or trade journal.[191] Refiners do not need to include crude oil capacity used in 2002 through a lease agreement with another refiner in which it has no ownership interest.

The crude oil capacity information reported to the EIA is presumed to be correct. However, in cases where a company disputes this information, we will allow 60 days after the company submits its application for small refiner status for that company to petition us with

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[190] "Subsidiary" here covers entities of which the parent company has 50 percent or greater ownership.

[191] We will evaluate each foreign refiner's documentation of crude oil capacity on an individual basis.

detailed data it believes shows that the EIA's data was in error. We will consider this data in making a final determination about the refiner's crude oil capacity.

Finally, applications for small refiner status must also include information on which small refiner option the refiner expects to use at each of its refineries.

3. Applications for Refiner Hardship Relief

As discussed above in section IV.C, a refiner seeking general hardship relief under today's program will apply to EPA and provide several types of financial and technical information, such as internal cash flow data and information on bank loans, bonds, and assets as well as detailed engineering and construction plans and permit status. Applications for general hardship relief are due June 1, 2005.

4. Pre-Compliance Reports for Refiners

We believe that an early general understanding of the refining industry's progress in complying with the requirements in today's rule will be valuable to both the industry and EPA. As with the highway diesel program, we are requiring that each refiner and importer provide annual reports on the progress of compliance and plans for compliance for each of their refineries or import facilities. These pre-compliance reports are due June 1 of each year beginning in 2005 and continuing through 2011, or until the production of 15 ppm sulfur NR and LM diesel fuel commences, whichever is later.

EPA will maintain the confidentiality of information submitted in pre-compliance reports to the full extent authorized by law. We will report generalized summaries of this data following receipt of the pre-compliance reports. We recognize that plans may change for many refiners or importers as the compliance dates approach. Thus, submission of the reports will not impose an obligation to follow through on plans projected in the reports.

Pre-compliance reports can, at the discretion of the refiner/importer, be submitted in conjunction with the annual compliance reports discussed below and/or the pre-compliance and annual compliance reports required under the highway diesel program, as long as all of the information that is required in all reports is clearly provided. Based on experience with the first pre-compliance reports for the highway diesel program, we are clarifying the information request for the pre-compliance reports as shown below. This should provide responses in a more standardized format which will allow for better aggregation of the data, as well as eliminate reporting of unnecessary information.

Pre-compliance reports must include the following information:

- Any changes in the basic corporate or facility information since registration;

- Estimates of the average daily volumes (in gallons) of each sulfur grade of highway and NRLM diesel fuel produced (or imported) at each refinery (or facility). These volume estimates must be provided both for fuel produced from crude oil, as well as any fuel produced from other sources, and must be provided for the periods of June 1, 2010 - December 31, 2010, calendar years 2011-13, January 1, 2014 - May 31, 2014, and June 1, 2014 - December 31, 2014;
- For entities expecting to participate in the credit program, estimates of numbers of credits to be earned and/or used;
- Information on project schedule by known or projected completion date (by quarter) by the stage of the project. For example, following the five project phases described in EPA's June 2002 Highway Diesel Progress Review report (EPA420-R-02-016): 1) Strategic planning, 2) planning and front-end engineering, 3) detailed engineering and permitting, 4) procurement and construction, and 5) commissioning and startup.
- Basic information regarding the selected technology pathway for compliance (e.g., conventional hydrotreating vs other technologies, revamp vs grassroots, etc.);
- Whether capital commitments have been made or are projected to be made ; and
- The pre-compliance reports in 2006 and later years must provide an update of the progress in each of these areas.

5. Compliance Reports for Refiners, Importers, and Distributors of Designated Diesel Fuel

a. Designate and Track Reporting Requirements

i. Quarterly Reports

From June 1, 2007 and through September 1, 2010, all entities who are required to maintain records must report the following information by facility to EPA on a quarterly basis:

- The total volume in gallons of each type of designated diesel fuel for which custody was transferred by the entity to any other entity, and the EPA entity and facility identification number(s), as applicable, of the transferee; and
- The total volume in gallons of each type of designated diesel fuel for which custody was received by the entity from any other entity and the EPA entity and facility identification number(s), as applicable, of the transferor.

If a facility receives fuel from another facility that does not have an EPA facility identification number then that batch of fuel must be designated and reported as 1) heating oil if it is marked, 2) highway diesel fuel if taxes have been assessed, 3) NRLM diesel fuel if the fuel is dyed but not marked.

Terminals must also report the results of all compliance calculations including the following:

- The total volumes received of each fuel designation required to be reported over the quarterly compliance period;
- The total volumes transferred of each fuel designation required to be reported over the quarterly compliance period;
- Beginning and ending inventories of each fuel designation required to be reported over the quarterly compliance period;
- Calculations showing that the volume of highway diesel fuel distributed from the facility relative to the volume received did not increase since June 1, 2007; and
- Calculations showing that the volume of high sulfur NRLM diesel fuel did not increase by a greater proportion than the volume of heating oil over the quarterly compliance period (not applicable in the Northeast/Mid-Atlantic Area or Alaska).

The quarterly compliance periods and dates by which the reports are due for each period are as follows.

Table V.G-1. Quarterly Compliance Periods and Reporting Dates[a]

Quarterly Compliance Period	Report Due Date
July 1 through September 30	November 30
October 1 though December 31	February 28
January 1 through March 31	May 31
April 1 through June 30	August 31

Notes: [a] The first quarterly reporting period will be from June 1, 2007 though September 30, 2007 and the last quarterly compliance period will be from April 1, 2010 through May 31, 2010.

ii. Annual Reports

Beginning June 1, 2007, all entities that are required to maintain records for batches of fuel must report by facility on an annual basis (due August 31) information on the total volumes received of each fuel designation as well as the results of all compliance calculations including the following:

- The total volumes transferred of each fuel designation;
- Beginning and ending inventories of each fuel designation;
- In Alaska, for diesel fuel designated as high sulfur NRLM delivered from June 1, 2007 through May 31, 2010 and for diesel fuel designated as 500 ppm sulfur NRLM delivered from June 1, 2010 through May 31, 2014, refiners must report all information required under their individual compliance plan, including the end-users to whom each batch of fuel was delivered and the total delivered to each end-user for the compliance period;

- Ending with the report due August 31, 2010, calculations showing that the volume of highway diesel fuel distributed from the facility relative to the volume received did not increase since June 1, 2007;
- Ending with the report due August 31, 2010, calculations showing that the volume of highway diesel fuel distributed from the facility relative to new volume received did not increase over the annual compliance period by more than two percent of the total volume of highway diesel fuel received;
- Ending with the report due August 31, 2010, calculations showing that the volume of high sulfur NRLM diesel fuel did not increase by a greater proportion than the volume of heating oil over the annual compliance period (not applicable in the Northeast/Mid-Atlantic Area or Alaska);
- Calculations showing that the volume of heating oil did not decrease over the annual compliance period, beginning June 1, 2010 (not applicable in the Northeast/Mid-Atlantic Area or Alaska); and
- From June 1, 2010 through August 1, 2012, calculations showing that the volume of 500 ppm sulfur NR diesel fuel did not increase by a greater proportion than the volume of 500 ppm sulfur LM diesel fuel over the annual compliance period (not applicable in the Northeast/Mid-Atlantic Area and Alaska.

b. Other Reporting Requirements

After the NRLM diesel fuel sulfur requirements begin on June 1, 2007, refiners and importers will be required to submit annual compliance reports for each refinery or import facility. If a refiner produces 15 ppm sulfur or 500 ppm sulfur fuel early under the credit provisions, its annual compliance reporting requirement will begin on June 1 following the beginning of the early fuel production. These reporting requirements will sunset after all flexibility provisions end (i.e., after May 31, 2014). Annual compliance reports will be due on August 31.

A refiner's or importer's annual compliance report must include the following information for each of its facilities:

- Batch reports for each batch produced or imported providing information regarding volume, designation (e.g., 500 highway), sulfur level and whether the fuel was dyed and/or marked. Each batch can only have one designation. Therefore, if a refiner ships 100 gallons of 500 ppm sulfur fuel in 2007 and wants to designate 50 gallons as highway 500 and 50 gallons as NR 500, the refiner must report two separate batches and there must be two PTDs–one for 50 gallons of highway 500 and one for 50 gallons of NR 500).

- Report on the generation, use, transfer and retirement of diesel sulfur credits. Credit transfer information must include the identification of the number of credits obtained from, or transferred to, each entity. Reports must also show the credit balance at the start of the period, and the balance at the end of the period. NRLM

or nonroad diesel sulfur credit information is required to be stated separately from highway diesel credit information since the two credit programs are treated separately.

- For a small refiner that elects to produce 15 ppm sulfur NRLM diesel fuel by June 1, 2006 and therefore is eligible for a limited relaxation in its interim small refiner gasoline sulfur standards, the annual reports must also include specific information on gasoline sulfur levels and progress toward highway and NRLM diesel fuel desulfurization.

6. PTDs

Refiners, importers, and other parties in the distribution system must provide information on commercial PTDs that identify diesel fuel distributed by use designation and sulfur content; i.e., for use in or motor vehicles, nonroad equipment, locomotive and marine equipment, or nonroad, locomotive, and marine diesel equipment, as appropriate, and the sulfur standard to which the fuel is subject. The PTD must indicate whether the fuel is diesel fuel, heating oil, kerosene, exempt fuel, or other. It must further state whether it is No. 1 or No. 2, dyed or undyed, marked heating oil, marked LM fuel, or unmarked. The specific designations on PTDs will change during the course of the program. For example, the highway designation for 500 ppm sulfur fuel ends after 2010. Where a party delivers or receives a particular load of fuel that has a uniform sulfur content but that has two different designations, the parties must utilize two different PTDs. For example, if, in 2007 a refiner moves 1,000 gallons of 500 ppm sulfur diesel into a pipeline, and the refiner's designation is that half of that product is highway 500 and half is nonroad 500, the parties would utilize one PTD for 500 gallons of highway 500 ppm sulfur diesel fuel and another for 500 gallons of nonroad 500 diesel fuel.

As in other fuels programs, PTDs must accompany each transfer of either title or custody of fuel. However, only custody transfers are relevant to compliance with the designation and tracking requirements and the downgrade limitations, and transfers to retail outlets and wholesale purchaser-consumers of fuel by distributors below the truck rack are not covered by the designate and track scheme. Therefore, the PTDs for these non-designate and track transfers are somewhat more straightforward.

We believe this additional information on commercial PTDs is necessary to maintain the integrity of the various grades of diesel fuel in the distribution system. Parties in the system will be better able to identify which type of fuel they are dealing with and more effectively ensure that they are meeting the requirements of today's program. This in turn will help to ensure that misfueling of sulfur sensitive engines does not occur and that the program results in the needed emission reductions.

Today's rule allows the use of product codes to convey the required information, except for transfers to truck carriers, retailers and wholesale purchaser-consumers. We believe that more

explicit language on PTDs to these parties is necessary since employees of such parties are less likely to be aware of the meaning of product codes. PTDs will not be required for transfers of product into nonroad, locomotive, or marine equipment at retail outlets or wholesale purchaser-consumer facilities with the exception of mobile refuelers. Mobile refuellers are required to provide a separate PTD to their customers for each type of fuel (e.g., 500 ppm sulfur NRLM diesel fuel, 15 ppm sulfur NRLM diesel fuel, or 15 ppm highway diesel fuel) that they dispense from tanker trucks or other vessels into motor vehicles, nonroad diesel engines or nonroad diesel engine equipment, for each instance when they refuel such equipment at a given location.[192]

a. Kerosene and Other Distillates to Reduce Viscosity

To ensure that downstream parties can determine the sulfur level of kerosene or other distillates that may be distributed for use for blending into 15 ppm sulfur highway or NRLM diesel fuel, for example, to reduce viscosity in cold weather, we are requiring that PTDs identify distillates specifically distributed for such use as meeting the 15 ppm sulfur standard.

b. Exported Fuel

Consistent with other EPA fuel programs, NRLM diesel fuel exported from the U.S. is not required to meet the sulfur standards of today's regulations. For example, where a refiner designates a batch of diesel fuel for export, and can demonstrate through commercial documents that the fuel was exported, such fuel would not be required to comply with the NRLM sulfur standards in today's rule. Product transfer documents accompanying the transfer of custody of the fuel at each point in the distribution system are required to state that the fuel is for export only and may not be used in the United States.

c. Additives

Today's rule requires that PTDs for additives for use in NRLM diesel fuel state whether the additive complies with the 15 ppm sulfur standard. Like the highway diesel rule, this program allows the sale of additives, for use by fuel terminals or other parties in the diesel fuel distribution system, that have a sulfur content greater than 15 ppm under specified conditions.

For additives that have a sulfur content less than 15 ppm, the PTD must state: "The sulfur content of this additive does not exceed 15 ppm." For additives that have a sulfur content greater than 15 ppm, the additive manufacturer's PTD, and PTDs accompanying all subsequent transfers, must provide a warning that the additive's sulfur content exceeds 15 ppm; the maximum sulfur content of the additive; the maximum recommended concentration for use of the additive in diesel fuel (stated as gallon of additive per gallon of diesel fuel); and the increase in sulfur concentration of the fuel the additive will cause when used at the maximum recommended concentration.

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[192] Only one PTD is required for each fuel designation or classification regardless of the number of motor vehicles or the number of diesel-powered NRLM equipment that are fueled.

Today's rule contains provisions for aftermarket additives sold to owner/operators for use in diesel powered nonroad equipment. These provisions are in response to concerns that additives designed for engines not requiring 15 ppm sulfur fuel, such as locomotive or marine engines, could accidentally be introduced into nonroad engines if they had no label stating appropriate use. Beginning June 1, 2010, aftermarket additives for use in nonroad equipment must be accompanied by information that states that the additive complies with the 15 ppm sulfur standard. We believe this information is necessary for end users to determine if an additive is appropriate for use.

7. Record-keeping Requirements for Refiners and Importers

Refiners and importers of distillate fuel must maintain the following designate and track records for the distillate fuel they produce and/or import. The specific types of distillate fuel that are subject to these record-keeping requirements are described below for the various periods of the program. [193]

- Batch number (including whether it is an incoming or out-going batch for refineries that also handle previously designated fuel);
- Batch designation;
- Volume in gallons;
- Date/time of day of custody transfer; and
- Name and EPA entity and facility identification number of the facility to which the batch was transferred.

For highway diesel fuel, the records must also identify whether the batch was received or delivered with or without taxes assessed. For NRLM diesel fuel, the records must also identify whether the batch was received or delivered with or without the IRS red dye. For heating oil, the records must indicate whether the batch was received or delivered with or without the fuel marker. From June 1, 2010, through May 31, 2012, the records for LM fuel batches must also indicate whether the batch was received or delivered with or without the fuel marker.

In addition to the designate and track records, refiners and importers must maintain the following records on the highway and NRLM diesel fuel that they produce and/or import:

- PTDs;
- Sampling and testing results for sulfur content (for highway and NRLM diesel fuel that is subject to either the 15 ppm or 500 ppm sulfur standards), as well as sampling and testing results that are part of a quality assurance program;
- Sampling and testing results for the cetane index or aromatics content, as well as sampling and testing results for additives;

[193] Transmix processors and terminal operators acting as refiners that produce 500 ppm sulfur diesel fuel for sale into the locomotive and marine markets are also subject to the recordkeeping requirements.

- Records on credit generation, use, transfer, purchase, or termination, maintained separately for the highway and NRLM diesel fuel credit programs; and
- Records related to individual compliance plans, if applicable, and annual compliance calculations.

a. June 1, 2006 through May 31, 2007

Refiners and importers must maintain the records listed above for each batch of diesel fuel that they designate and transfer custody of during the time period from June 1, 2006 through May 31, 2007, with the following fuel types:

- No. 1 15 ppm sulfur highway diesel fuel;
- No. 2 15 ppm sulfur highway diesel fuel;
- 15 ppm sulfur NRLM diesel fuel;
- No. 1 500 ppm sulfur highway diesel fuel;
- No. 2 500 ppm sulfur highway diesel fuel; or
- 500 ppm sulfur NRLM diesel fuel.

b. June 1, 2007 through May 31, 2010

Refiners and importers must maintain the records listed above for each batch of distillate fuel that they designate and transfer custody of during the time period from June 1, 2007 through May 31, 2010 with the following fuel types:

- No. 1 15 ppm sulfur highway diesel fuel;
- No. 2 15 ppm sulfur highway diesel fuel;
- 15 ppm sulfur NRLM diesel fuel;
- No. 1 500 ppm sulfur highway diesel fuel;
- No. 2 500 ppm sulfur highway diesel fuel; or
- 500 ppm sulfur NRLM diesel fuel;
- High sulfur NRLM diesel fuel; or
- Heating oil.

c. June 1, 2010 through May 31, 2012

Refiners and importers must maintain the records listed above for each batch of diesel fuel that they designate and transfer custody of during the time period from June 1, 2010 through May 31, 2012, with the following fuel types:

- 500 ppm sulfur NR diesel fuel;
- 500 ppm sulfur LM diesel fuel; or
- Heating oil.

d. June 1, 2012 through May 31, 2014

Refiners and importers must maintain the records listed above for each batch of distillate fuel that they transfer custody of and designate during the time period from June 1, 2012 through May 31, 2014 with the following fuel types:

- 15 ppm sulfur highway or NRLM diesel fuel;
- 500 ppm sulfur NRLM diesel fuel diesel fuel; or
- Heating oil.

d. June 1, 2014 and Beyond

Refiners and importers must maintain the records listed above for each batch of heating oil that they transfer custody of and designate during the time period from June 1, 2014 and beyond.

8. Record-keeping Requirements for Distributors

Distributors of distillate fuel must maintain the following designate and track records on a facility-specific basis for the distillate fuel they distribute. The specific distillate fuel designations that are subject to these record-keeping requirements are described below for the various periods of the program.

- Batch number (including whether it is an incoming or out-going batch);
- Batch designation;
- Volume in gallons;
- Date/time of day of custody transfer;
- Name and EPA entity and facility identification number of the facility from which the fuel batch was received or to which the fuel batch was delivered;
- Beginning and ending inventory volumes on a quarterly basis; and
- Inventory adjustments.

For highway diesel fuel, the records must also identify whether the batch was received or delivered with or without taxes assessed. For NRLM diesel fuel, the records must also identify whether the batch was received or delivered with or without the IRS red dye. For heating oil, the records must indicate whether the batch was received or delivered with our without the fuel marker. From June 1, 2010, through October 1, 2012, the records must indicate whether LM fuel was received or delivered with or without the fuel marker.[194] In addition to these designate and

[194] After August 1, 2012, LM fuel distributed from terminals must contain a concentration of the marker no greater than 0.1 mg/L. After October 1, 2012, LM fuel at any location in the fuel distribution system must contain no more than a trace amount of the marker (0.1 mg/L).

track records, distributors will be required to maintain records related to their quarterly and annual compliance calculations as well as copies of all PTDs.

If a facility receives fuel from another facility that does not have an EPA facility identification number then that batch of fuel must be designated as 1) heating oil if it is marked, or from 2010 through 2012, LM diesel fuel if the fuel is dyed and marked and is not heating oil 2) highway diesel fuel if taxes have been assessed, and 3) NRLM diesel fuel if the fuel is dyed but not marked.

If a facility delivers fuel to other facilities and that fuel is either 500 ppm sulfur highway diesel fuel on which taxes have been assessed or 500 ppm sulfur NRLM, or LM diesel fuel into which red dye has been added pursuant to IRS requirements, then the facility does not need to maintain separate records for each of the other facilities to which it delivered fuel. Similarly, if a facility delivers batches of marked heating oil to other facilities, then it does not need to maintain separate records for each of the other facilities to which it delivered the marked heating oil. If a facility only receives marked heating oil (i.e., it does not receive any unmarked heating oil), then it does not need to maintain any heating oil records. Similarly, if a facility only receives highway diesel fuel on which taxes have been assessed or NRLM diesel fuel which has been dyed pursuant to IRS regulations (i.e., it does not receive any untaxed highway diesel fuel or undyed NRLM diesel fuel), then it does not need to maintain records of the 500 ppm sulfur highway or NRLM diesel fuel that it receives.

a. June 1, 2006 through May 31, 2007

Facilities that receive No. 2 15 ppm sulfur highway diesel fuel and distribute any No. 2 500 ppm sulfur highway diesel fuel, must maintain records for each batch of diesel fuel with the following designations that they receive or deliver during the time period from June 1, 2006 through May31, 2007:

- No. 1 15 ppm sulfur highway diesel fuel;
- No. 2 15 ppm sulfur highway diesel fuel;
- No. 2 500 ppm sulfur highway diesel fuel; and
- 500 ppm sulfur NRLM diesel fuel.

b. June 1, 2007 through May31, 2010

All facilities must maintain records for each batch of diesel fuel or heating oil with the following designations for which they receive or transfer custody during the time period from June 1, 2007 through May31, 2010:

- No. 1 15 ppm sulfur highway diesel fuel;
- No. 2 15 ppm sulfur highway diesel fuel;
- No. 1 500 ppm sulfur highway diesel fuel;

- No. 2 500 ppm sulfur highway diesel fuel;
- 500 ppm sulfur NRLM diesel fuel;
- 15 ppm sulfur NRLM diesel fuel;
- High sulfur NRLM diesel fuel; and
- Heating oil.

c. June 1, 2010 through May31, 2012

All facilities must maintain records for each batch of diesel fuel or heating oil with the following designations for which they receive or transfer custody during the time period from June 1, 2007 through May 31, 2012. This requirement does not apply to facilities located in the Northeast/Mid-Atlantic Area or Alaska.

- 500 ppm sulfur NR diesel fuel;
- 500 ppm sulfur LM diesel fuel; or
- Heating oil.

c. June 1, 2012 through May 31, 2014

Facilities that receive unmarked fuel designated as heating oil, must maintain records for each batch of diesel fuel with the following designations that they receive or deliver during the time period from June 1, 2012 through May 31, 2014. This requirement does not apply to facilities located in Alaska or the Northeast/Mid-Atlantic Area unless they deliver marked heating oil to facilities outside of these areas.

- 500 ppm sulfur NRLM diesel fuel; and
- Heating oil.

d. June 1, 2014 and Beyond

Facilities that receive unmarked fuel designated as heating oil must maintain records for each batch of diesel fuel with the following designations that they receive or deliver during the time period beginning June 1, 2014. This requirement does not apply to facilities located in Alaska or the Northeast/Mid-Atlantic Area unless they deliver marked heating oil to facilities outside of these areas.

- 500 ppm sulfur LM diesel fuel, and
- Heating oil.

9. Record-keeping Requirements for End-Users

Today's program also contains certain record-keeping provisions for end-users. From June 1, 2007 through October 1, 2010, end-users that receive any batch of high sulfur NRLM in Alaska must maintain records of each batch of fuel received for use in NRLM equipment unless otherwise allowed by EPA. From June 1, 2010 through October 1, 2012, end-users that receive any batch of 500 ppm sulfur NR in Alaska must maintain records of each batch of fuel received for use in NR equipment unless otherwise allowed by EPA. In addition, from June 1, 2012 through October 1, 2014, end-users that receive any batch of 500 ppm sulfur NRLM in Alaska must maintain records of each batch of fuel received for use in NRLM equipment unless otherwise allowed by EPA.

10. Record Retention

We are adopting a retention period of five years for all records required to be kept under today's rule. This is the same period of time required in other fuels rules, and it coincides with the applicable statute of limitations. We believe that most parties in the distribution system would maintain some or all of these records for this length of time even without the requirement.

This retention period applies to PTDs, records required under the designate and track provisions, records of any test results performed by any regulated party for quality assurance purposes or otherwise (whether or not such testing was required by this rule), along with supporting documentation such as date of sampling and testing, batch number, tank number, and volume of product. Business records regarding actions taken in response to any violations discovered must also be maintained for five years.

All records that are required to be maintained by refiners or importers participating in the generation or use of credits, hardship options (or by importers of diesel fuel produced by a foreign refiner approved for the temporary compliance option or a hardship option), including small refiner options, are also covered by the retention period.

H. Liability and Penalty Provisions for Noncompliance

1. General

The liability and penalty provisions of the today's NRLM diesel sulfur rule are very similar to the liability and penalty provisions found in the highway diesel sulfur rule, the gasoline sulfur rule, the reformulated gasoline rule and other EPA fuels regulations.[195] Regulated parties

[195] See section 80.5 (penalties for fuels violations); section 80.23 (liability for lead violations); section 80.28 (liability for gasoline volatility violations); section 80.30 (liability for highway diesel violations); section 80.79 (liability for violation of RFG prohibited acts); section 80.80 (penalties for

are subject to prohibitions which are typical in EPA fuels regulations, such as prohibitions on selling or distributing fuel that does not comply with the applicable standard, and causing others to commit prohibited acts. For example, liability will also arise under the NRLM diesel rule for violating certain prohibited acts and requirements, such as: distributing or dispensing NR diesel fuel not meeting the 15 ppm sulfur standard for use in model year 2011 or later nonroad equipment (and after Dec 1, 2014 into any nonroad diesel equipment); distributing or dispensing diesel fuel not meeting the 500 ppm sulfur standard for locomotive and marine engines; distributing fuel containing the marker for use in engines that require the use of fuel that does not contain the marker; prohibitions and requirements under the designate and track provisions in today's rule, including specific prohibitions and requirements regarding fuel produced or distributed in the Northeast/Mid-Atlantic Area or in Alaska.[196]

Small refiners and refiners using credits can produce high sulfur NRLM when NRLM would otherwise be required to meet a 500 ppm sulfur standard, and can produce 500 ppm sulfur NR or LM diesel fuel when nonroad or LM diesel fuel would otherwise be required to meet a 15 ppm sulfur standard. A refiner that produces fuel under the small refiner and credit provisions would be in violation unless they can demonstrate that they meet the definition of a small refiner or have sufficient credits for the volume of fuel produced. All regulated parties will be liable for a failure to meet certain requirements, such as the record-keeping, reporting, or PTD requirements, or causing others to fail to meet such requirements.

Under today's rule, the party in the diesel fuel distribution system that controls the facility where a violation occurred, and other parties in that fuel distribution system (such as the refiner,

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RFG/CG violations); section 80.395 (liability for gasoline sulfur violations); section 80.405 (penalties for gasoline sulfur regulations).; and section 80.610-614 (prohibited acts, liability for violations, and penalties for highway diesel sulfur regulations.

[196] Today's rule, in 40 CFR § 80.610, provides that no person shall, *inter alia*, "dispense, supply, offer for supply, store or transport . . ." fuel not in compliance with applicable standards and requirements starting on a certain date. These prohibitions apply at downstream locations such as retail outlets, wholesale purchaser-consumer facilities as well as end-user locations. The act of storage or transport refers to storage or transport in fuel storage tanks from which fuel is dispensed into motor vehicles or NRLM engines or equipment. It does not refer to storing or transporting the fuel that is in the motor vehicle propulsion tank or other tank that is incorporated in the NRLM equipment for the purpose of supplying the engine with fuel. While the prohibition against dispensing inappropriate fuels does apply as of the applicable date, the motor vehicle or NRLM engine or equipment may continue to burn any fuel in the motor vehicle fuel tank or NRLM equipment fuel tank that was properly dispensed into such tank .

reseller, and distributor), will be presumed to be liable for the violation.[197] As in the Tier 2 gasoline sulfur rule and the highway diesel fuel rule, today's rule explicitly prohibits causing another person to commit a prohibited act or causing non-conforming diesel fuel to be in the distribution system. Non-conforming fuels include: 1) diesel fuel with sulfur content above 15 ppm incorrectly represented as appropriate for model year 2011 or later nonroad equipment or other engines requiring 15 ppm fuel; 2) diesel fuel with sulfur content above 500 ppm incorrectly represented as appropriate for nonroad equipment or locomotives or marine engines after the applicable date for the 500 ppm sulfur standard for these pieces of equipment; 3) heating oil that is required to contain the marker which does not, LM fuel which is required to contain the marker which does not, or other fuels that are required to be free of the marker in which the marker is present; 4) fuel designated or labeled as 500 ppm sulfur highway diesel fuel above and beyond the volume balance limitations; 5) fuel designated or labeled as NRLM above and beyond the volume balance limitations; or 6) fuels otherwise not complying with the requirements of this rule. Parties outside the diesel fuel distribution system, such as diesel additive manufacturers and distributors, are also subject to liability for those diesel rule violations which could have been caused by their conduct.

Today's rule also provides affirmative defenses for each party presumed liable for a violation, and all presumptions of liability are rebuttable. In general, in order to rebut the presumption of liability, parties will be required to establish that: 1) the party did not cause the violation; 2) PTD(s) exist which establish that the fuel or diesel additive was in compliance while under the party's control; and 3) the party conducted a quality assurance sampling and testing program. As part of their affirmative defense diesel fuel refiners or importers, diesel fuel additive manufacturers, and blenders of high sulfur additives into diesel fuel, will also be required to provide test results establishing the conformity of the product prior to leaving that party's control. Blenders of static dissipater additives have alternative defense provisions as discussed in section V.C. Branded refiners have additional affirmative defense elements to establish. The defenses under the nonroad diesel sulfur rule are similar to those available to parties for violations of the highway diesel sulfur, reformulated gasoline, gasoline volatility, and the gasoline sulfur regulations. Today's rule also clarifies that parent corporations are liable for violations of subsidiaries, in a manner consistent with the gasoline sulfur rule and the highway diesel sulfur rule. Finally, the NRLM diesel sulfur rule mirrors the gasoline sulfur rule and the highway diesel sulfur rule by clarifying that each partner to a joint venture will be jointly and severally liable for the violations at the joint venture facility or by the joint venture operation.

As is the case with the other EPA fuels regulations, today's rule will apply the provisions of section 211(d)(1) of the Clean Air Act (Act) for the collection of penalties. These penalty provisions currently subject any person that violates any requirement or prohibition of the diesel sulfur rule to a civil penalty of up to $32,500 for every day of each such violation and the amount

[197] An additional type of liability, vicarious liability, is also imposed on branded refiners under today's rule.

of economic benefit or savings resulting from the violation.[198] A violation of a NRLM diesel sulfur standard will constitute a separate day of violation for each day the diesel fuel giving rise to the violation remains in the fuel distribution system. Under today's regulation, the length of time the diesel fuel in question remains in the distribution system is deemed to be twenty-five days unless there is evidence that the fuel remained in its distribution system a lesser or greater amount of time. This is the same time presumption that is incorporated in the RFG, gasoline sulfur and highway diesel sulfur rules. The penalty provisions in today rule are also be similar to the penalty provisions for violations of these regulations.

EPA has included in today's rule two prohibitions for "causing" violations: 1) causing another to commit a violation; and 2) causing non-complying diesel fuel to be in the distribution system. These causation prohibitions are like similar prohibitions included in the gasoline sulfur and the highway diesel sulfur regulations, and, as discussed in the preamble to those rules, EPA believes they are consistent with EPA's implementation of prior motor vehicle fuel regulations. See the liability discussion in the preamble to the gasoline sulfur final rule, at 65 FR 6812 *et seq*.

The prohibition against causing another to commit a violation will apply where one party's violation is caused by the actions of another party. For example, EPA may conduct an inspection of a terminal and discover that the terminal is offering for sale nonroad diesel fuel designated as complying with the 15 ppm sulfur standard, while the fuel, in fact, had an actual sulfur content greater than the standard.[199] In this scenario, parties in the fuel distribution system, as well as parties in the distribution system of any diesel additive that had been blended into the fuel, will be presumed liable for causing the terminal to be in violation. Each party will have the right to present an affirmative defense to rebut this presumption.

The prohibition against causing non-compliant diesel fuel to be in the distribution system will apply, for example, if a refiner transfers non-compliant diesel fuel to a pipeline. This prohibition could encompass situations where evidence shows high sulfur diesel fuel was transferred from an upstream party in the distribution system, but EPA may not have test results to establish that parties downstream also violated a prohibited act with this fuel.

The Agency expects to enforce the liability scheme of the NRLM diesel sulfur rule in the same manner that we have enforced the similar liability schemes in our prior fuels regulations. As in other fuels programs, we will attempt to identify the party most responsible for causing the violation, recognizing that party should primarily be liable for penalties for the violation.

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[198] This limit is amended periodically pursuant to Congressional authority to change maximum civil penalties to account for inflation.

[199] At downstream locations the violation will occur if EPA's test result show a sulfur content of greater than 17 ppm, which takes into account the two ppm adjustment factor for testing reproducibility for downstream parties.

2. What are the Liability Provisions for Additive Manufacturers and Distributors, and Parties That Blend Additives into Diesel Fuel?

a. General

The final highway diesel rule permits the blending of diesel fuel additives with sulfur content in excess of 15 ppm into 15 ppm highway diesel fuel under limited circumstances. As more fully discussed earlier in this preamble, this rule also permits downstream parties to blend fuel additives having a sulfur content exceeding 15 ppm into 15 ppm nonroad diesel, provided that: 1) the blending of the additive does not cause the diesel fuel's sulfur content to exceed the 15 ppm sulfur standard; 2) the additive is added in an amount no greater than one volume percent of the blended product; and 3) the downstream party obtained from its additive supplier a product transfer document ("PTD") with the additive's sulfur content and the recommended treatment rate, and that it complied with such treatment rate. As discussed in section V.C, today's rule includes alternate affirmative defense requirements for blenders of S-D additives that can contribute a maximum of 0.050 ppm to the sulfur content of finished fuel subject to the 15 ppm sulfur standard. Today's rule also implements these same alternate defense requirements regarding the blending of such additives into 15 ppm highway diesel fuel.

Since today's rule permits the limited use in nonroad diesel fuel of additives with high sulfur content, the Agency believes it might be more likely that a diesel fuel sulfur violation could be caused by the use of high sulfur additives. This could result from the additive manufacturer's misrepresentation or inaccurate statement of the additive's sulfur content or recommended treat rate on the additive's PTD, or an additive distributor's contamination of low sulfur additives with high sulfur additives during transportation. The increased probability that parties in the diesel additive distribution system could cause a violation of the sulfur standard warrants the imposition by the Agency of increased liability for such parties. Therefore, today's rule, like the final highway diesel rule, explicitly makes parties in the diesel additive distribution system liable for the sale of nonconforming diesel fuel additives, even if such additives have not yet been blended into diesel fuel. In addition, today's rule imposes presumptive liability on parties in the additive distribution system if diesel fuel into which the additive has been blended is determined to have a sulfur level in excess of its permitted concentration. This presumptive liability will differ depending on whether the blended additive was designated as meeting the 15 ppm sulfur standard (a "15 ppm additive") or designated as a greater than 15 ppm sulfur additive (a "high sulfur additive"), as discussed below.

b. Liability When the Additive Is Designated as Complying with the 15 ppm Sulfur Standard

Additives blended into diesel fuel downstream of the refinery are required to have a sulfur content no greater than 15 ppm, and be accompanied by PTD(s) accurately identifying them as complying with the 15 ppm sulfur standard, with the sole exception of diesel additives blended

into nonroad diesel fuel at a concentration no greater than one percent by volume of the blended fuel.

All parties in the fuel and additive distribution systems will be subject to presumptive liability if the blended fuel exceeds the sulfur standard. The two ppm downstream adjustment will apply when EPA tests the fuel subject to the 15 ppm sulfur standard. Low sulfur additives present a less significant threat to diesel fuel sulfur compliance than would occur with the use of additives designated as possibly exceeding 15 ppm sulfur. Thus, parties in the additive distribution system of the low sulfur additive could rebut the presumption of liability by showing the following: 1) additive distributors will only be required to produce PTDs stating that the additive complies with the 15 ppm sulfur standard; 2) additive manufacturers are also be required to produce PTDs accurately indicating compliance with the regulatory requirements, as well as producing test results, or retained samples on which tests could be run, establishing the additive's compliance with the 15 ppm sulfur standard prior to leaving the manufacturer's control. Once they meet their defense to presumptive liability, these additive system parties will only be held responsible for the diesel fuel non-conformity in situations in which EPA can establish that the party actually caused the violation.

Under today's rule, parties in the diesel fuel distribution system will have the typical affirmative defenses of other fuels rules. For parties blending an additive into their diesel fuel, the requirement to maintain PTDs showing that the product complied with the regulatory standards will necessarily include PTDs for the additive that was used, affirming the compliance of the additive and the fuel.

c. Liability When the Additive Is Designated as Having a Possible Sulfur Content Greater than 15 ppm

Under today's rule, a nonroad diesel fuel additive will be permitted to have a maximum sulfur content above 15 ppm if the blended fuel continues to meet the 15 ppm standard and the additive is used at a concentration no greater than one volume percent of the blended fuel. However, if nonroad diesel fuel containing that additive is found by EPA to have high sulfur content, then all the parties in both the additive and the fuel distribution chains will be presumed liable for causing the nonroad diesel fuel violation.

Since this type of high sulfur additive presents a much greater probability of causing diesel fuel non-compliance, parties in the additive's distribution system will have to satisfy an additional element to establish an affirmative defense. In addition to the elements of an affirmative defense described above, parties in the additive distribution system for such a high sulfur additive will also be required to establish that they did not cause the violation, an element of an affirmative defense that is typically required in EPA fuel programs to rebut presumptive liability.

Parties in the diesel fuel distribution system will essentially have to establish the same affirmative elements as in other fuels rules, with an addition comparable to the highway diesel

rule. Blenders of high sulfur additives into 15 ppm sulfur nonroad diesel fuel, will have to establish a more rigorous quality control program than will exist without the addition of such a high sulfur additive. For additives other than static dissipater additives, to establish a defense to presumptive liability, the Agency has adopted the proposal to require test results establishing that the blended fuel was in compliance with the 15 ppm sulfur standard after being blended with the high sulfur additive. This additional defense element will be required as a safeguard to ensure nonroad diesel fuel compliance, since the blender has voluntarily chosen to use an additive which increases the risk of diesel fuel non-compliance.

An exception to this defense element is made for blenders of static dissipater additives, that are allowed by today's rule to contribute no more than 0.05 ppm to the sulfur content of a finished fuel subject to the 15 ppm sulfur standard. As discussed in section V.C.5, blenders of such additives may rely on volume accounting reconciliation records in lieu of the requirement to sample and test each batch of fuel subject to the 15 ppm sulfur standard after the addition of an additive that exceeds the 15 ppm sulfur standard. Today's rule also implements these same alternate defense requirements regarding the blending of such additives into 15 ppm highway diesel fuel.

I. How Will Compliance with the Sulfur Standards Be Determined?

Today's rule provides that compliance with the sulfur standards and use requirements under today's rule can be determined by evaluating the designate and track records (discussed in section IV.D.) and other records, such as PTDs; by evaluating compliance with the fuel marker requirements discussed in section IV.D and V.E; and by sampling fuel and testing for sulfur content. Today's rule includes a requirement for refiners and importers to measure the sulfur content of every batch of NRLM fuel designated under the rule, using a testing methodology approved under the provisions discussed in section V.H of this preamble. In general, downstream parties must conduct only periodic sampling and testing as an element of a defense to presumptive liability (retailers are exempt from sampling and testing). Today's rule further provides that in determining compliance, any evidence from any source or location can be used to establish the diesel fuel sulfur level, provided that such evidence is relevant to whether the sulfur level would have met the applicable standard had compliance been determined using an approved test methodology. While the use of a non-approved test method might produce results relevant to determining sulfur content, this does not remove any liability for failing to conduct required batch testing using an approved test method. This is consistent with the approach taken under the gasoline sulfur rule and the highway diesel sulfur rule.

For example, the Agency might not have sulfur results derived from an approved test method for diesel fuel sold by a terminal, yet the terminal's own test results, based on testing using methods other than those approved under the regulations, could reliably show a violation of the sulfur standard. Under today's rule, evidence from the non-approved test method could be used to establish the diesel fuel's sulfur level that would have resulted if an approved test method had been conducted. This type of evidence is available for use by either the EPA or the regulated

party, and could be used to show either compliance or noncompliance. Similarly, absent the existence of sulfur test results using an approved method, commercial documents asserting the sulfur level of diesel fuel or additive could be used as some evidence of what the sulfur level of the fuel would be if the product would have been tested using an approved method.

The Agency believes that the same statutory authority for EPA to adopt the gasoline sulfur rule's evidentiary provisions, Clean Air Act section 211(c), provides appropriate authority for the evidentiary provisions of today's diesel sulfur rule. For a fuller explanation of this statutory authority, see the gasoline sulfur final rule preamble, 65 FR 6815, February 10, 2000.

VI. Program Costs and Benefits

In this section, we present the projected cost impacts and cost effectiveness of the nonroad Tier 4 emission standards and fuel sulfur requirements. We also present a benefit-cost analysis and an economic impact analysis. The benefit-cost analysis explores the net yearly economic benefits to society of the reduction in mobile source emissions likely to be achieved by 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, equipment and fuel that would be affected by the standards.

We revised our cost and benefit analysis to reflect the comments we received on our analysis. The fuel-related costs have been updated to reflect information received from refiners as part of EPA's highway diesel fuel program, comments received on the nonroad NPRM, as well as more recent information available on future energy costs and the cost of advanced desulfurization technologies. The engine and equipment-related costs were revised to reflect additional R&D costs associated with tailoring R&D to each particular engine line and to accommodate changes in the final emission control requirements, particularly with regard to engines above 750 hp. These costs also now presented in 2002 instead of 2001 dollars. With regard to the benefits analysis, we have updated our methods consistent with Science Advisory Board (SAB) advice as specified in RIA chapter 9. Finally, we adjusted the economic impact analysis to reflect the revised cost inputs and to explicitly model the impacts on the locomotive and marine intermediate market sectors.

The results detailed below show that this rule would be highly beneficial to society, with net present value benefits through 2036 of $805 billion using a 3 percent discount rate and $352 billion using a 7 percent discount rate, compared to a net present value of social cost of about $27 billion using a 3 percent discount rate and $14 billion using a 7 percent discount rate. The impact of these costs on society should be minimal, with the prices of goods and services produced using equipment and fuel affected by standards being expected to increase about 0.1 percent.

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

A. Refining and Distribution Costs

Meeting the 500 and 15 ppm sulfur caps will generally require that refiners add hydrotreating equipment and possibly new or expanded hydrogen and sulfur plants in their refineries. We have estimated the cost of building and operating this equipment using the same basic methodology which was described in the NPRM. We have updated that analysis with new information obtained from the vendors of advanced desulfurization technology, to better reflect current crude oil properties and refinery configurations, as well as future hydrogen costs. We have also incorporated information received from refiners regarding their plans to produce 15 ppm

highway diesel fuel from 2006-2010. Finally, we incorporated the 15 ppm cap on locomotive and marine fuel in 2012, as well as improving our analysis of the impact of this cap on costs incurred in the distribution system.

The costs to provide NRLM fuel under the two-step fuel program are summarized in Table VI.A-1 below. All of the following costs estimates are in 2002 dollars. Capital investments have been amortized at 7 percent per annum before taxes. These estimates do not include costs associated with fuel sulfur testing, labeling, reporting or record keeping, which we believe will be small relative to those associated with refining, distribution and lubricity additives. A more detailed description of the costs associated with this final rule is presented in the Final RIA.

Table VI.A-1. – Cost of Providing NRLM Diesel Fuel (cents per gallon of affected fuel)

NRLM Diesel Fuel	Years	Affected Fuel Volume (million gallons per year)[a]	Refining	Distribution (and Lubricity)	Total
500 ppm	2007-2010	11,860	1.9	0.2	2.1
	2010-2012	3,589	2.7	0.6	3.3
	2012-2014	715	2.9	0.6	3.5
15 ppm	2010-2012	8,145	5.0	0.8	5.8
	2012-2014	12,068	5.6	0.8	6.4
	2014 +	13,399	5.8	1.2	7.0

Notes: [a] Volumes shown are for first full year in each period (2008, 2011, 2013, and 2015).

The costs shown (and all of the costs described in the rest of this section) apply to the 74 percent of current NRLM fuel that currently contains more than 500 ppm sulfur (hereafter referred to as the affected volume).

In 2014, the affected volume of NRLM fuel is 14.6 billion gallons out of total NRLM fuel volume of 19.7 billion gallons. The other 5.1 billion gallons of NRLM fuel is currently spillover from fuel certified to the highway diesel fuel standards. We expect this to continue under the 2007 highway diesel fuel program. Thus, 26 percent of NRLM fuel will already meet at least a 500 ppm sulfur cap by 2007 and a 15 ppm cap by 2010 and will not be affected by today's rule. The costs and benefits of desulfurizing this highway fuel which spills over into the non-highway markets was included in our cost estimates for the 2007 highway diesel fuel rule.

The estimated cost of the first step of the NRLM fuel program is slightly less than that projected in the NPRM (cents per gallon). However, we have increased our estimated cost of the second step significantly in response to comments. These comments and the changes to our cost estimates are discussed in more detail in the next two sections. The combined cost for both steps

is therefore somewhat higher than expected in the NPRM, but nevertheless consistent with projections for the cost of 15 ppm highway diesel fuel.

We expect that the increased cost of refining and distributing 500 ppm NRLM fuel will be completely offset by reductions in maintenance costs, while those for 15 ppm NRLM fuel will be significantly offset. These savings will apply to all diesel engines in the fleet due to the reduced fuel sulfur content, not just new engines. Refer to section V. B for a more complete discussion on the projected maintenance savings associated with lower sulfur fuels.

1. Refining Costs

Methodology: We followed the same process that we used in the NPRM to project refining costs, though we have broken down the description into five steps instead of four.

First, we estimate the total volume of NRLM fuel which must be desulfurized during each step of the program, as well as each refinery's future total production of distillate fuel. Current and future demand for all distillate fuels except diesel fuel for land-based equipment were based on estimates from the Energy Information Administration's (EIA) Fuel Oil and Kerosene Survey (FOKS) for 2001 and the 2003 Annual Energy Outlook (AEO). EPA's NONROAD emission model was used to estimate both current and future fuel consumption by land-based nonroad equipment to ensure the consistent treatment of both the costs and benefits associated with this rule. Table VI.A-2 shows our projections of the volumes of fuel affected by today's rule. These volumes exclude NRLM fuel expected to be certified to highway diesel fuel sulfur caps prior to the implementation of this rule. They also exclude distillate fuel meeting a 500 ppm cap which is produced during distribution from highway diesel fuel, jet fuel, etc.

Table VI.A-2. – Volume of NRLM Fuel Affected by Today's Rule (billion gallons per year)

	Nonroad		**Locomotive and Marine**		**Total**	
	500 ppm	15 ppm	500 ppm	15 ppm	500 ppm	15 ppm
2008	8,406	0	3,454	0	11,860	0
2011	614	8,145	2,975	0	3,589	8,145
2013	468	8,671	247	3,395	715	12,066
2015	0	10,539		2,860	0	13,399

This marks a change from the proposal, where all distillate fuel volumes were based on EIA FOKS and AEO estimates. Commenters pointed out that this approach underestimated fuel-related costs relative to emission reductions and monetized benefits, since the NONROAD fuel volumes used to estimate the latter were larger. We in fact had acknowledged this inconsistency in the proposal and had said we would address it in the final rule. Our approach to address the

inconsistency was to utilize the land-based nonroad fuel volumes estimated by the NONROAD model for both the costs and monetized benefits. However, we also conducted a sensitivity analysis whereby both emissions and costs were estimated using EIA estimates of fuel demand by land-based nonroad equipment. The results of that analysis are discussed in chapter VII of the Final RIA.

We made one other revision to the volume of diesel fuel affected by this rule. In analyzing the impact of the 2007 highway diesel fuel program for the NPRM analysis, we estimated that 4.4 percent of 15 ppm highway diesel fuel would be contaminated during shipment and not available for sale as 15 ppm highway fuel. This increased the volume of 15 ppm highway fuel which had to be produced at refineries before accounting for the production of additional 500 and 15 ppm NRLM fuel in response to the NRLM fuel program. Due to comments made on the NRPM (discussed in section VI.A.3. below), we have improved our analysis to track the disposition of this contaminated 15 ppm fuel. Much of this contaminated fuel can be sold as 500 ppm NRLM from 2007-2014 and as L&M fuel thereafter. Thus, the contaminated 15 ppm fuel reduces the volume of 500 and 15 ppm NRLM fuel which must be produced at refineries.

Second, total distillate production by individual refineries were based on their actual production volumes in 2002, as reported to EIA. This represents a minor revision to the NPRM analysis, which utilized actual refiner production in 2000. The number of refineries needing to produce 500 ppm and 15 ppm diesel fuel under today's final rule was based on the projected diesel fuel and heating oil demand in 2014.[200] To be consistent, the 2002 distillate production volumes of individual refiners were increased to 2014 levels using EIA projections of growth in total distillate production by domestic refiners.

Third, we estimated the cost to desulfurize diesel fuel to both 500 ppm and 15 ppm for each domestic refinery. This considered both the volume of diesel fuel being produced and its composition (e.g., percentage of straight run, light cycle oil, etc.). Estimates of the volumes of diesel fuel already being desulfurized to meet the highway diesel fuel standards in 2006-2010 prior to the implementation of this final rule were based on refiners' pre-compliance reports.[201] This marks a change from the NPRM analysis, where we assumed that refiners would continue to produce their current mix of highway and high sulfur diesel fuel. While many refiners indicated that their plans were preliminary and subject to change, we consider these projections to be more

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[200] The year 2014 represents a mid-point between the initial year of today's fuel program and the end of the expected life of desulfurization equipment (roughly 15 years).

[201] Under EPA's 2007 highway diesel program, refiners are required to submit their production plans for highway diesel fuel for 2006-2010. The first of these reports were due during the summer of 2003. EPA published a summary of the results this past fall. We consider these reports to provide a more accurate projection of individual refinery plans than our projections made during the highway fuel FRM. The latter was based on cost minimization using our refinery-specific desulfurization refinery model.

probable than assuming that current producers of diesel fuel will make no change to their product mix in complying with the highway rule. Meeting the 15 ppm highway diesel fuel cap will require significant investment, but some refiners will face more than others. Some refiners will be able to revamp their current hydrotreater, while others will need to build an entirely new unit. Some refiners will be able to expand their production of highway fuel at little incremental cost, while others will be able to reduce their investment substantially by reducing their production volume. Use of refiners' own projections, as opposed to our own cost methodology assumptions, allows us to incorporate as much refinery-specific information as is currently possible.

In projecting desulfurization costs, we updated a number of the inputs to our cost estimation methodology. We increased natural gas and utility costs to reflect those projected in EIA's 2003 AEO. The NPRM analysis utilized projections from 2002 AEO. Forecasted natural gas costs in 2003 AEO are considerable higher than in 2002 AEO, though still lower than current market prices. In response to comments, we also increased the factor for off-site capital costs to better reflect the cost of sulfur plant expansions. The NPRM analysis utilized an off-site factor developed in support of the Tier 2 gasoline and 2007 highway diesel fuel programs, where the amount of sulfur removed per gallon was a fraction of that occurring here with NRLM fuel. We also continued to update our cost estimates for advanced desulfurization technologies, as these technologies continue their evolution. As discussed in Section IV, the latest information concerning Process Dynamics's IsoTherming process indicate somewhat higher costs than earlier estimates. We also reduced our projection of the penetration of these advanced technologies in 2010 from 80 to 60 percent.

Fourth, we estimated which refineries will likely find it difficult to stay in the heating oil market after the implementation of the NRLM sulfur standards, due to their location relative to major pipelines and the size of the heating oil market in their area. Those not located in major heating oil markets and not connected to pipelines serving these areas were projected to have to meet the 500 and 15 ppm caps in 2007 and 2010, respectively.

Fifth, we estimated which of the remaining refineries would likely produce NLRM fuel under today's program. As was done in the proposal, we assumed that those refineries with the lowest projected compliance costs would be the most likely to produce the required fuel until demand was met. Inter-PADD transfers of fuel between PADD 3 and PADD 1 were not constrained. PADD 3 refineries were also assumed to supply PADD 2 with 15 ppm NRLM fuel once all PADD 2 refineries were producing 15 ppm distillate fuel. We also assumed that domestic refineries would preferentially supply the lowest sulfur fuels compared to imports. Thus, imports of 15 and 500 ppm NRLM fuel were only assumed after all refineries in a PADD were projected to produce either 15 or 500 ppm fuel, respectively. The small refiner provisions included in today's NRLM fuel program were considered, as these provisions temporarily reduce the volume of 500 and 15 ppm fuel required to be produced in 2007 and 2010, respectively. This portion of the methodology was the same as that used in the NRPM analysis.

Results: Based on EIA data, in 2002 114 refineries produced highway diesel fuel and 102 refineries produce high sulfur diesel fuel or heating oil. Based on refiners' pre-compliance reports, we project that 100 refineries will produce 15 ppm highway diesel fuel; 96 refineries starting in 2006 and 4 in 2010. Of these 100 refineries, 96 currently produce some volume of highway diesel fuel, while 4 refineries currently only produce high sulfur distillate fuel. Also, 18 refineries will cease to produce highway diesel fuel and shift to producing solely high sulfur distillate fuel. This will leave a total of 92 refineries still producing high sulfur distillate after full implementation of the 2007 highway diesel fuel program.

The number of these 92 domestic refineries expected to produce either 15 or 500 ppm NRLM diesel fuel in response to today's rule is summarized in Table VI.A-3.

Table VI.A-3. – Refineries Projected to Produce NRLM Diesel Fuel Under This Final Rule

Year of Program	500 ppm NRLM Diesel Fuel		15 ppm NRLM Diesel Fuel	
	All Refineries	Small Refineries	All Refineries	Small Refineries
2007-2010	36	0	0	0
2010-2012	26	13	32	2
2012-2014	15	13	47	2
2014+	0	0	63	15

During the four periods shown in table VI.A-3, two roughly parallel sets of standards become effective. For non-small refiners, the 500 ppm NRLM fuel cap starts in 2007, followed by the 15 ppm nonroad fuel cap in 2010, in turn followed by the 15 ppm L&M fuel cap in 2012. For small refiners, the 500 ppm NRLM fuel cap starts in 2010, followed by the 15 ppm nonroad NRLM fuel cap in 2014. As shown, beginning in 2014, 63 refineries are projected to be affected by today's final rule. After complete implementation of today's rule, 29 refineries are expected to be able to produce high sulfur heating oil, some as their entire distillate production, others along with 15 ppm fuel. The number of refineries estimated to be affected by today's rule is one more than that projected in the NPRM. There, we estimated that 62 refineries would have to produce either 15 or 500 ppm NRLM fuel in 2014 and beyond.

We project that the capital cost involved to meet the 2007 500 ppm sulfur cap will be $310 million. This represents about $10 million for each of the 30 refineries building a new hydrotreater. Six refineries are expected to produce 500 ppm NRLM fuel using existing hydrotreaters no longer being used to produce 500 ppm highway fuel. The total investment cost is roughly half that projected in the NPRM ($600 million). The decrease is due to a greater volume of 500 ppm NRLM fuel coming from existing hydrotreaters. This conclusion is based on the number of refineries leaving the highway diesel fuel market according to the refiners' highway program pre-compliance reports. The investment per refinery that we projected in the NPRM

($9.7 million) was essentially unchanged. Operating costs will be about $4.9 million per year for the average refinery, or slightly greater than that projected in the NPRM (due to higher hydrogen costs and a lower percentage of hydrocrackate in the NRLM pool). The average cost of producing 500 ppm NRLM fuel in 2007 will be 1.9 cents per gallon, 0.3 cent per gallon lower than that projected in the NPRM, due primarily to the reduced capital expenditure.

In 2010, an additional $1170 million will be invested in revamped and new desulfurization equipment, $1090 million to meet the 15 ppm nonroad fuel cap and $80 million to produce 500 ppm NRLM fuel no longer eligible for a small refiner exemption to sell high sulfur NRLM fuel. In 2012, an additional $590 million will be invested in revamped and new desulfurization equipment to meet the 15 ppm L&M cap Finally, in 2014 an additional $210 million will be invested in additional 15 ppm fuel capacity. Thus, total capital cost of new equipment and revamps related to the NRLM fuel program will be $2280 million, or $36 million per refinery, roughly 5 percent greater than that projected in the NPRM. Total operating costs will be about $8.1 million per year for the average refinery, slightly lower than that projected in the NPRM ($8.3 million per year). The total refining cost, including the amortized cost of capital, will be 5.0, 5.6 and 5.8 cents per gallon of new 15 ppm NRLM fuel in 2010, 2012, and 2014, respectively.

The 500 pm NRLM fuel being produced in 2010 is projected to cost 2.7 cents per gallon. The cost of this 500 ppm fuel is higher than that projected in the NPRM, due primarily to a higher cost for natural gas in the future. The 500 pm, small refiner fuel being produced in 2012 is projected to cost 2.9 cents per gallon. All of these costs are relative to the cost of producing high sulfur fuel today, and includes the cost of meeting the 500 ppm standard beginning in 2007.

The 15 ppm refining costs are significantly higher than the 4.4 cent per gallon cost projected in the NPRM for the option where L&M fuel was controlled to 15 ppm in addition to nonroad fuel. The increase is due to the changes in refining cost methodology described above, particularly the reduced use of advanced desulfurization technology, reduced synergies with the highway fuel program and increased natural gas costs.

The average refining costs by refining region are shown in table VI.A-4 below. These costs include consideration of the small refiner provisions. Combined costs are shown for PADDs 1 and 3 because of the large volume of diesel fuel which is shipped from PADD 3 to PADD 1.

Table VI.A-4. – Average Refining Costs by Region (cents per gallon)

	500 ppm Cap			15 ppm Cap		
	2007-2010	**2010-2012**	**2012-2014**	**2010-2012**	**2012-2014**	**2014+**
PADDs 1 & 3	1.6	3.7	2.5	4.6	4.9	5.1
PADD 2	2.8	2.9	3.7	7.1	7.8	7.8
PADD 4	3.3	9.0	9.0	11.6	11.7	11.8
PADD 5	1.2	2.8	3.5	4.3	4.3	5.7
Nationwide	1.8	2.7	2.9	5.0	5.6	5.8

Fuel-Only Control Programs: We used the same methodology to estimate refining costs for stand-alone 500 ppm and 15 ppm NRLM fuel programs. The fully phased in refining impacts of a 15 ppm NRLM standard are the same as those described above for the final rule in 2014 and beyond. A fully phased in 500 ppm NRLM fuel program is projected to affect 63 refineries, cost 2.0 cents per gallon and require a capital investment of $480 million.

2. Distribution Costs

Today's rule is projected to impact distribution costs in four ways. First, we project that a slightly greater volume of diesel fuel will have to be distributed, due to the fact that some of the desulfurization processes reduce the fuel's volumetric energy density during processing. Total energy is not lost during processing, as the total volume of fuel is increased in the hydrotreater. However, a greater volume of fuel must be consumed in the engine to produce the same amount of power. We project that desulfurizing diesel fuel to 500 ppm will reduce volumetric energy content by 0.7 percent. The cost of which is equivalent to 0.08 cent per gallon of affected NRLM fuel.[202] We project that desulfurizing diesel fuel to 15 ppm will reduce volumetric energy content by an additional 0.52 percent. This will increase the cost of distributing fuel by an additional 0.05 cents per gallon, for a total cost of 0.13 cents per gallon of affected 15 ppm NRLM fuel.

The second impact on distribution costs relates to the disposition of 15 ppm fuel contaminated during pipeline shipment. We received comments that the control of L&M fuel sulfur content, particularly to 15 ppm, would make it difficult to sell off-specification 15 ppm fuel. The comments argued that much of this material would have to be shipped back to refineries and reprocessed to meet the 15 ppm cap. We designed the program finalized today to allow the continued sale of 500 ppm fuel into the NRLM market until June 1, 2014, and into the locomotive and marine market indefinitely. By doing so, we were able to minimize, though not eliminate, much of the reprocessing and distribution cost impacts of concern. We have evaluated both the

[202] See chapter 7 of the RIA for further details regarding our estimation of distribution costs.

production and potential sale of distillate interface and estimated the distribution cost impacts of today's final rule provisions. The details of this analysis are contained in chapter 7 of the Final RIA.

In our analysis of the 15 ppm highway fuel program, we projected that the need to protect the quality of 15 ppm highway diesel fuel would increase the volume of highway diesel fuel downgraded to a lower value product, such as high sulfur diesel fuel and heating oil, from its current level of approximately 2.2 percent to 4.4 percent. Under today's rule, we expect that 15 ppm NRLM fuel will be shipped together with 15 ppm highway. Thus, the size of each batch of 15 ppm fuel will increase, but the number of batches will not. As the downgrade occurs at the interface between batches, the volume being downgraded should not increase. At the same time, we are not projecting that interface volume will decrease, as high sulfur fuels, such as jet fuel and, in some cases heating oil, will still be in the system.

The issue here is the market to which this interface volume can be sold. When this interface volume meets the specifications of one of the two fuels being shipped next to each other, the interface is simply added to the batch of that fuel. For example, the interface between regular and premium gasoline is added to the regular grade batch. Or, the interface between jet fuel and heating oil is added to the heating oil batch. One interface which is never added to either adjacent batch is a mixture of gasoline and any distillate fuel, such as jet or diesel fuel. If this interface was added to the distillate batch, the gasoline content in the interface would result in a violation of the distillate's flash point specification. If this interface was added to the gasoline batch, it would cause the gasoline to violate its end point specification. Therefore, this interface must be shipped to a transmix processor to separate the mixture into naphtha (a sub-octane gasoline) and distillate. The 2007 highway diesel fuel program will not change this practice. The naphtha produced by transmix processors from gasoline/distillate mixtures is usually blended with premium gasoline to produce regular grade gasoline. The distillate produced is an acceptable high sulfur diesel fuel or heating oil, though if the feed material was primarily low sulfur distillate and gasoline it will likely also meet the current 500 ppm highway fuel cap.

With the implementation of the highway diesel rule, there is another incompatible interface, that between jet fuel and 15 ppm diesel fuel. This interface can not be cut into jet fuel due to end point and other concerns. However, it can usually be cut into 500 ppm diesel fuel as long as the sulfur level of the jet fuel is not too high. With the lowering of the highway standard to 15 ppm, however, this will no longer be possible. We expect that pipelines minimize this interface by abutting jet fuel and high sulfur distillate in the pipeline whenever possible. However, it will be unavoidable under many circumstances. A substantial part of the pipeline distribution system currently does not handle high sulfur distillate, and we expect that the highway program and today's rule will likely cause additional pipeline systems to discontinue carrying high sulfur distillate. Pipelines that do not carry high sulfur distillates will generate this interface

whenever they ship jet fuel.[203] The highway rule, and today's rule projects that pipeline operators will segregate this interface by cutting it into a separate storage tank. Because this interface can be sold as 500 ppm NRLM fuel or heating oil, and because these markets exist nationwide, there is little impact beyond the need for refiners to produce more 15 ppm highway diesel fuel (compared to the volume of highway diesel fuel produced prior to the implementation of the 15 ppm standard), which was considered as part of the refining costs in the highway diesel rule.

With control of nonroad fuel to 15 ppm sulfur in 2010 and LM fuel to 15 ppm sulfur in 2012, the opportunities to downgrade interface to another product become increasing limited. Where limited this will increase costs due to the need to transport the interface to where it can be marketed or to a facility for reprocessing. In areas with large heating oil markets, such as the Northeast and the Gulf Coast, the control of NRLM sulfur content will still have little impact on the sale of this interface. However, in areas lacking a large heating oil market, the sale of this distillate interface will be more restricted. Because this interface will composed of 15 ppm diesel fuel and jet fuel, we estimate that the distillate interface created should nearly always meet a 500 ppm cap.[204] Thus, this interface can be added to 500 ppm NRLM batches (as well as heating oil, where it is present at the terminal) through 2014. After 2014, this 500 ppm interface fuel can only be sold as L&M fuel or heating oil. An exception to this applies in the Northeast/Mid-Atlantic Area, where this interface cannot be sold into the nonroad fuel market after 2010, nor into the L&M fuel market after 2012.

In chapter 7 of the Final RIA, we estimate the costs related to handling this interface fuel during the four time periods (2007-2010, 2010-2012, 2012-2014, and 2014 and beyond). We project that there will be no additional costs prior to 2010, as 500 ppm fuel will be the primary NRLM fuel and be widely distributed. Beyond 2010, we estimate that terminals will have to add a small storage tank for this fuel, as 500 ppm highway diesel fuel and the majority of 500 ppm NRLM disappears from the distribution system. In many places, this interface will be the primary, if not sole source of 500 ppm fuel, so existing tankage to add this interface to will be limited. We have also added shipping costs to transport this fuel to NRLM and heating oil users. The volume of this interface is significant, sometimes a sizeable percentage of the combined NRLM fuel and heating oil markets. In the post-2014 period, the volume of this interface fuel is larger than the combined L&M fuel and heating oil markets in certain PADDs. Also, the volume

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[203] We expect that only three types of fuel will be carried by such pipeline systems: jet fuel, 15 ppm diesel fuel, and gasoline (premium and regular). Premium and regular gasolines are always shipped next to each other so the interface between premium and regular gasoline can be cut into the batch of regular gasoline. Thus, whenever jet fuel is shipped it will abut 15 ppm diesel fuel on one end and gasoline on the other.

[204] See chapter 7.1.7 of the RIA regarding our analysis of the sulfur levels of this interface material. This analysis indicated that although the maximum sulfur specification of jet fuel 3,000 ppm, in-use jet fuel sulfur levels are frequently below 500 ppm.

of interface received at each terminal will vary substantially, depending on where that terminal is on the pipeline. The advantage of this is that where the interface accumulates it may be of sufficient volume to justify marketing as a separate grade of fuel. Conversely, the potential users of this 500 ppm interface fuel may not be located near the terminals with the fuel necessitating additional transportation costs.

Prior to 2014, 500 ppm fuel can be used as NRLM fuel and heating oil outside of the Northeast/Mid-Atlantic Area. Additional storage tanks will be needed in some cases, as this will be the only source of 500 ppm fuel in the marketplace. Amortizing the cost of a range of storage tank sizes over 15 years of weekly shipments at a seven percent rate of return before taxes costs produced an amortized cost of 0.2-1.6 cents per gallon. These costs include the carrying cost of the fuel stored in the tank. We estimate that the average storage cost will be closer to the lower end of this range, or 0.5 cent per gallon. Nonroad fuel users are fairly ubiquitous. Thus, increased shipping distances should be fairly short. We estimated 45 miles at a cost of roughly 1.5 cents per gallon. The distance to L&M fuel users will likely be longer, roughly 100 miles, but cost the same due to greater efficiencies of rail transport. It will likely cost more to deliver interface fuel to heating oil users, as many of these users are smaller, not evenly dispersed geographically, purchase fuel seasonally, and lack rail connections. We estimate that transport distances will increase an average of 85 miles and cost an additional 3.0 cents per gallon over today's costs to deliver this fuel to the end user, in addition to the 0.5 cent per gallon storage cost. When spread over all the 15 and 500 ppm NRLM fuel being produced from 2010-2014 due to today's rule, the additional distribution cost from 2010-2014 is 0.4 cents per gallon.

Starting in 2014, this interface fuel can no longer be sold to the nonroad fuel market. Since the interface volume does not change, this increases the volume of fuel that must be sold to the L&M and heating oil markets. Thus, overall, transportation distances and costs will likely increase. We expect that the transportation cost for fuel sold to the L&M market will increase from 1.5 to 3.0 cents per gallon, while that for heating oil will increase to 5.0 cents per gallon, both including fuel storage. However, in PADD 5, the volume of interface generated exceeds the total fuel demand of these two markets. Thus, we estimate that some fuel will have to be shipped back to refineries and reprocessed to meet a 15 ppm cap and shipped out a second time. We estimate that the cost of this shipping and reprocessing will cost 10 cents per gallon. When spread over all the 15 ppm NRLM fuel being produced after 2014 due to today's rule, the additional distribution cost is 0.8 cent per gallon.

The third impact of today's rule on distribution costs is related to the need for additional storage tanks to market additional product grades at bulk plants. While this final rule minimizes the segregation of similar fuels, some additional segregation of products in the distribution system will still be required. The allowance that highway and NRLM diesel fuel meeting the same sulfur specification can be shipped fungibly until it leaves the terminal obviates the need for additional storage tanks in this segment of the distribution system except for the limited tankage at terminals

necessary to handle 500 ppm sulfur interface fuel discussed above.[205] Today's final rule also allows 500 ppm NRLM diesel fuel to be mixed with high-sulfur NRLM (though it can no longer be sold as 500 ppm fuel).

However, we expect that the implementation of the 500 ppm standard for NRLM diesel fuel in 2007 will compel some bulk plants in those parts of the country still distributing heating oil as a separate fuel grade to install a second diesel storage tank to handle this 500 ppm NRLM fuel. These bulk plants currently handle only high-sulfur fuel and hence will need a second tank to continue their current practice of selling fuel into the heating oil market in the winter and into the nonroad market in the summer. We believe that some of these bulk plants will convert their existing diesel tank to 500 ppm fuel in order to avoid the expense of installing an additional tank. However, to provide a conservatively high estimate we assumed that 10 percent of the approximately 10,000 bulk plants in the U.S. (1,000) will install a second tank in order to handle both 500 ppm NRLM diesel fuel and heating oil.

The cost of an additional storage tank at a bulk plant is estimated at $90,000 and the cost of de-manifolding a delivery truck is estimated at $10,000.[206] In the NPRM, we estimated that each bulk plant that needed to install a new storage tank would need to de-manifold a single tank truck. Thus, the NPRM estimated the cost per bulk plant would be $100,000. Fuel distributors stated that the assumptions and calculations made by EPA in characterizing costs for bulk plant operators seem reasonable. However, they also stated that our estimate that a single tank truck would service a bulk plant is probably not accurate. No suggestion was offered regarding what might be a more appropriate estimate other than the number is likely to be much greater. Part of the reason why we estimated that only a single tank truck would need to be de-manifolded, is that we expected that due to the seasonal nature of the demand for heating oil versus nonroad fuel, it would primarily only be at the juncture of these two seasons that both fuels would need to be distributed in substantial quantities. We also expected that the small demand for heating oil in the summer and the small demand for nonroad fuel in the winter could be serviced using a single de-manifolded truck. The primary fuel distributed during a given season would be distributed by single compartment tank trucks. During the crossover between seasons, bulk plant operators would switch the fuel to which such single compartment tank trucks are used from nonroad to heating oil and back again.[207] Nevertheless, we agree that the subject bulk plant operators would likely be compelled to de-manifold more that a single tank truck. Lacking additional specific information, we believe that assuming that each bulk plant operator de-manifolds three tank trucks will provide a conservatively high estimate of the cost to bulk plant operators due to today's rule.

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[205] Including the refinery, pipeline, terminal, marine tanker, and barge segments of the distribution system.

[206] This estimated cost includes the addition of a separate delivery system on the tank truck.

[207] To avoid sulfur contamination of NRLM fuel, the tank compartment would need to be flushed with some NRLM fuel prior to switching from carrying heating oil to NRLM fuel.

If all 1,000 bulk plants were to install a new tank and de-manifold three tank trucks, the cost for each bulk plant would $120,000, and the total one-time capital cost would be $120,000,000. To provide a conservatively high estimate of the costs to bulk plant operators, we are assuming that all 1,000 bulk plants will do so. Amortizing the capital costs over 20 years, results in a estimated cost for tankage at such bulk plants of 0.1 cents per gallon of affected NRLM diesel fuel supplied. Although the impact on the overall cost of the program is small, the cost to those bulk plant operators who need to put in a separate storage tank may represent a substantial investment. Thus, we believe many of these bulk plants will search out other arrangements to continue servicing both heating oil and NRLM markets such as an exchange agreement between two bulk plants that serve a common area.

As a consequence of the end of the highway program's temporary compliance option (TCO) in 2010 and the disappearance of high-sulfur diesel fuel from much of the fuel distribution system resulting from the implementation of today's rule, we expect that storage tanks at many bulk plants that were previously devoted to 500 ppm TCO highway fuel and high-sulfur fuel will become available for dyed 15 ppm nonroad fuel service. Based on this assessment, we do not expect that a significant number of bulk plants will need to install an additional storage tank in order to provide dyed and undyed 15 ppm diesel fuel to their customers beginning in 2010 (the implementation date for the 15 ppm nonroad standard) .[208] There could potentially be some additional costs related to the need for new tankage in some areas not already carrying 500 ppm fuel under the temporary compliance option of the highway diesel program and which continue to carry high sulfur fuel. However, we expect them to be minimal relative to the above 0.1 cent per gallon cost. Thus, we estimate that the total cost of additional storage tanks at bulk plants that will result from today's rule will be 0.1 cent per gallon of affected NRLM diesel fuel supplied.

The fourth impact on fuel distribution costs is a result of the requirement that high sulfur heating oil be marked beginning June 1, 2007 and that 500 ppm sulfur LM diesel produced by refiners or imported be marked from 2010 through 2012 outside of the Northeast/Mid-Atlantic Area and Alaska. The NPRM projected that there would be no capital costs associated with the proposed marker requirement. We proposed that the marker would be added at the refinery gate, and that the current requirement that non-highway fuel be dyed red at the refinery gate be made voluntary. Thus, we believed that the refiner's additive injection equipment that is currently used to inject red dye into off-highway diesel fuel could instead be used to inject the marker as needed. As a result of the allowance provided in today's final rule that the marker be added at the terminal rather than the refinery gate, and our reevaluation of the conditions for dye injection at the refinery, we are now assessing capital costs for terminals and refiners related to compliance with the fuel marker requirements.

Except for fuel that is distributed directly from a refiner's rack, today's final rule allows the marker to be added at the terminal rather than at the refinery as we proposed (see section IV.D

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[208] See Section IV of today's preamble for additional discussion of our rational for this conclusion.

for a discussion of the fuel marker requirements).[209] We expect that except for fuel dispensed directly from the refinery rack, the fuel marker will be added to at the terminal to avoid the potential for marked fuel to contaminate jet fuel during distribution by pipeline. Terminals that need to inject the fuel marker will need to purchase a new injection system, including a marker storage tank and a segregated line and injector for each truck loading station at which fuel that is required to be marked is dispensed. Terminals will still be subject to IRS red dye requirements, and thus will not be able to rededicate such injection equipment to inject the fuel marker. Due to concerns regarding the need to maintain a visible evidence of the presence of the fuel marker, today's rule also contains a requirement that nay fuel which contains the fuel marker also contains visible evidence of red dye. Furthermore, there is little chance to adapt parts of the red dye injection system (such as the feed lines and injectors) for the alternate injection of red dye and the fuel marker due to concerns that NRLM fuel become contaminated with the marker.

Terminal operators expressed concern regarding the potential burden on terminal operators from the capital costs of adding new additive injection equipment for heating oil. In response to these comments, today's rule includes provisions that exempt terminal operators from the fuel marker requirements in a geographic "Northeast/Mid-Atlantic Area" and Alaska.[210] These provisions provide that any heating oil or 500 ppm sulfur LM diesel fuel that would otherwise be subject to the fuel marker requirements which is delivered to a retailer or wholesale-purchaser consumer inside the Northeast/Mid-Atlantic Area or Alaska does not need to contain the marker. The costs of the marker requirements for heating oil beginning in 2007 and for 500 ppm sulfur LM diesel fuel from 2010 through 2012 are discussed separately below.

The Northeast/Mid-Atlantic Area was defined to include the region where the majority of heating oil in the country is projected to continue to be supplied though the bulk distribution system (the Northeast and Mid-Atlantic). The vast majority of heating oil consumption in the U.S. will be within the Northeast/Mid-Atlantic Area. Outside of the Northeast/Mid-Atlantic Area, we expect that only limited quantities of heating oil will be supplied, primarily from certain refiner's racks. We estimate that 30 refineries and transmix processor facilities outside of the Northeast/Mid-Atlantic Area will distribute heating oil from their racks (in limited volumes) on a sufficiently frequent basis to warrant the installation of a marker injection system at a total one time cost of $1,500,000.

Terminals outside of the Northeast/Mid-Atlantic Area will mostly be located in areas without continued production and/or bulk shipment of heating oil. Consequently, any high sulfur

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[209] A refinery rack functions similar to a terminal in that it distributes fuel by truck to wholesale purchaser consumers and retailers.

[210] Small refiner and credit high sulfur NRLM will not be permitted to be sold in the area where terminals are not required to add the fuel marker to heating oil (the "Northeast/Mid-Atlantic Area"). See section IV.D.

diesel fuel they sell will typically be NRLM. Terminals located within the Northeast/Mid-Atlantic Area will not need to mark their heating oil, except for those few that choose to ship heating oil outside of the Northeast/Mid-Atlantic Area. The terminals most likely to install marker injection equipment will therefore be those in states outside the Northeast/Mid-Atlantic Area with modest markets for heating oil after the implementation of this program. As discussed in chapter 7 of the RIA, in analyzing the various situations, we project that fewer than 60 terminals nationwide will choose to install marker injection equipment at a total cost of $4,150,000.[211] The total capital cost to refiners and terminals to install marker injection equipment is estimated to be $5,650,000. Thus, the Northeast/Mid-Atlantic Area provisions in today's rule minimizes the number of terminals that will need to install additive injection equipment and its associated cost to comply with the marker requirement for heating oil.

In the NPRM we estimated that the cost to blenders of the fuel marker in bulk quantities would translate to 0.2 cents per gallon of fuel treated with the marker. This estimate was based on the fee charged by a major pipeline to inject red dye at the IRS concentration into its customers diesel fuel. We used this estimate because we lacked specific cost information on the proposed marker, and we believed that it provided a conservatively high estimate of marker cost. Since the proposal, we received input from a major distributor of fuel markers and dyes, regarding the cost of bulk deliveries of the specified fuel marker to terminals which translates to a cost of 0.03 cents per gallon of fuel treated with the marker. The volume of heating oil that we expect will need to be marked has also decreased substantially from that estimated in the NPRM due to the Northeast/Mid-Atlantic Area provisions. We estimate that 1.4 billion gallons of heating oil will be marked annually, for an annual marker cost of $425,000. In the NPRM, we projected that the cost of marking heating oil would continue for three years (2007 - 2010). Under today's final rule, heating oil must be marked indefinitely beginning in 2007, but only outside of the Northeast/Mid-Atlantic Area and Alaska.

Because heating oil outside of the Northeast/Mid-Atlantic Area is being marked to prevent its use in NRLM engines, for the purposes of estimating the impact of the marker requirement on the cost of the NRLM program we have spread the cost for the marker for heating oil over NRLM diesel fuel. Amortizing the capital costs of marker injection equipment over 20 years, results in an estimated cost of 0.006 cents per gallon of affected NRLM diesel fuel supplied. Spreading the cost of the marker over the volume of affected NRLM fuel results in an estimated cost of 0.003 cents per gallon of affected NRLM fuel. Adding the amortized cost of the injection equipment necessary to add the marker to heating oil and the cost or the marker results in a total estimated cost of the marker requirement for heating oil in today's rule of 0.01 cents per gallon of affected NRLM fuel.

The final NRLM rule also requires that 500 ppm L&M fuel produced at refineries or imported be marked from mid-2010 through mid-2012 outside of the Northeast/Mid-Atlantic Area

[211] The estimated marker injection equipment costs include the cost of marker storage tanks, lines, and injectors.

and Alaska. The adoption of a 15 ppm sulfur standard for LM diesel fuel in 2012 in today's rule allows us to require that LM fuel be marked from 2010 through 2012 rather than from 2010 through 2014 as proposed (see section IV.A). In addition, the way in which the program was crafted to avoid requiring the fuel marker be added to heating oil in the Northeast/Mid-Atlantic Area and Alaska allows us to also provide that 500 ppm sulfur LM diesel fuel in these areas is not subject to the marker requirement (see section IV.D). We project that only a small number of refiners will produce 500 ppm sulfur diesel fuel subject to the marker requirements fuel and that it will not be shipped via pipeline. Thus, most of this fuel can be marked at the refinery, limiting the number of facilities which need to add marking equipment in response to this requirement. We estimate that 15 facilities will have to do so, at a cost of $60,000 each, for a total of $900,000. Amortizing this over the total volume of affected NRLM fuel produced from mid-2010 to mid-2012 at seven percent per year before taxes yields a cost for the LM marker requirement of 0.004 cent per gallon. Including the cost of the marker (0.03 cent per gallon of marked fuel) increases this cost to 0.01 cent per gallon of NRLM fuel.

We summed these various costs incurred to the distribution system over four different time periods. As shown in table VI.A-5, the total additional distribution cost will be 0.2 cent per gallon of NRLM fuel during the first step of the fuel program (from 2007 through 2010), 0.6 cents gallon of NRLM fuel from 2010 to 2012 and from 2012 to 2014, and increase to 1.0 cent per gallon thereafter. A more detailed description of the costs associated with downgraded jet fuel and 15 ppm diesel fuel is presented in chapter 7 of the Final RIA.

Table VI.A-5. – Summary of Distribution Costs (cents per gallon)

Cause of Increase in Distribution Costs	**Time Period Over Which Costs Apply**			
	2007-2010	**2010-2012**	**2010-2014**	**2014+**
Distribution of additional NRLM volume	0.08	0.1	0.1	0.1
Distillate interface handling	0	0.4	0.4	0.8
Bulk plant storage tanks	0.1	0.1	0.1	0.1
Heating oil and L&M fuel marker	0.01	0.02	0.01	0.01
Total	0.2	0.6	0.6	1.0

3. Cost of Lubricity Additives

Hydrotreating diesel fuel tends to reduce the natural lubricating quality of diesel fuel, which is necessary for the proper functioning of certain fuel system components. There are a variety of fuel additives which can be used to restore diesel fuel's lubricating quality. These additives are currently used to some extent in highway diesel fuel. We expect that the need for lubricity additives that will result from the proposed 500 ppm sulfur standard for NRLM diesel

fuel will be similar to that for highway diesel fuel meeting the current 500 ppm sulfur cap standard.[212] Industry experience indicates that the vast majority of highway diesel fuel meeting the current 500 ppm sulfur cap does not need lubricity additives. Therefore, we expect that the great majority of NRLM diesel fuel meeting the proposed 500 ppm sulfur standard will also not need lubricity additives. In estimating lubricity additive costs for 500 ppm diesel fuel, we assumed that fuel suppliers will use the same additives at the same concentration as we projected will be used in 15 ppm highway diesel fuel. Based on our analysis of this issue for the 2007 highway diesel fuel program, the cost per gallon of the lubricity additive is about 0.2 cents. This level of use is likely conservative, as the amount of lubricity additive needed increases substantially as diesel fuel is desulfurized to lower levels. We also project that only five percent of all 500 ppm NRLM diesel fuel will require the use of a lubricity additive. Thus, we project that the cost of additional lubricity additives for the affected 500 ppm NRLM diesel fuel will be 0.01 cent per gallon. See the Final RIA for more details on the issue of lubricity additives. We have no reason to expect that the implementation of today's NRLM sulfur standards will impact diesel properties other than fuel lubricity in such a way as to require the use of additives.

We project that all NRLM fuel meeting a 15 ppm cap will require treatment with lubricity additives. Thus, the projected cost will be 0.2 cent per affected gallon of 15 ppm NRLM fuel.

4. How EPA's Projected Costs Compare to Other Available Estimates

Historically, the price of highway diesel fuel meeting a 500 ppm sulfur cap has exceeded that of high sulfur diesel fuel, ranging from 0-5 cents per gallon from 1995-99 and averaging 2.2 cent per gallon over this time period (see chapter 7 of the Final RIA). Fuel prices are often a function of market forces which might not reflect the cost of producing the fuel. Still, given this is a five-year average price difference, it is likely a reasonable indication of the cost of reducing highway diesel fuel sulfur to 500 ppm. Once the small refiner provisions applicable to 500 ppm fuel expire in 2010, we project that the total cost of the 500 ppm NRLM fuel cap will be 2.4 cents per gallon, well within the range of the historical highway-high sulfur fuel price difference. This similarity exists despite changes in a number of factors. One, our projection of future natural gas costs are significantly higher than those existing during the above price comparison. Two, the refineries producing highway diesel fuel historically likely did so because they faced lower costs than those refineries continuing to produce high sulfur distillate. Three, desulfurization catalyst efficiency has improved dramatically since the highway units were installed and significant operating experience has been obtained on highway units. Four, inflation since the early 1990's will have increased the cost of constructing the same hydrotreater. Five, and perhaps most importantly, the construction of some new hydrotreaters to produce 15 ppm highway diesel fuel will allow the existing hydrotreaters to produce 500 ppm NRLM fuel at no capital cost. Thus, there are at least five significant factors, two of which would tend to decrease costs and three of which would tend to increase costs. It is not surprising that these factors could counter-balance

[212] Please refer to section IV in today's preamble for additional discussion regarding our projections of the potential impact on fuel lubricity of this proposed rule.

each other, leading to the conclusion that the 500 ppm cap could be extended to NRLM fuel at roughly the same cost as for highway diesel fuel.

The only existing market for 15 ppm diesel fuel is a niche market for fleets and the prices for this fuel likely bear little resemblance to the costs of the 15 ppm highway or NRLM caps. Thus, the only cost comparisons which can be made are those between engineering studies. One such study was performed by Mathpro for the Engine Manufactures Association (EMA). Mathpro estimated the cost of controlling the sulfur content of highway and NRLM fuel to levels consistent with both 500 ppm and 15 ppm cap standards.[213] A detailed evaluation of the Mathpro costs is presented in the Final RIA. There are a number of aspects of the study that make direct comparisons between its estimates and our cost estimates difficult. Nonetheless, a crude comparison of 15 ppm costs indicates that our average cost range of 5.7-5.9 cent per gallon is quite similar to the 5.4-6.6 cents per gallon cost range estimated by Mathpro.

The other available study of 15 ppm fuel costs was performed by Baker and O'Brien for API and submitted in response to the nonroad NPRM. Baker and O'Brien analyzed two NRLM fuel control scenarios, but neither one matched today's final NRLM fuel program. The scenario closest to today's program assumed that a NRLM fuel would be capped at 15 ppm in 2008. In this case, Baker and O'Brien projected that the refinery-specific cost of 15 ppm NRLM fuel would range from 4-17 cents per gallon. This is higher than our projected range of 2-14 cents per gallon. In addition, as described in the next section, Baker and O'Brien projected that the volume of NRLM fuel produced at these costs would not fully satisfy NRLM fuel demand. Presumably, totally fulfilling NRLM fuel demand with domestic production would have cost more.

Baker and O'Brien described portions of their cost methodology and indicated some general assumptions which they made during the study. However, the absence of detail prevents any detailed comparisons of their results to ours. It was clear from their report, though, that Baker and O'Brien made a number of pessimistic assumptions about refiners' willingness to invest in desulfurization capacity and that this limited the number of refineries which they assumed would invest to meet the NRLM sulfur caps. This inevitably led to higher projected costs (and lower production volumes), than if all refineries had been considered. Thus, it is not surprising that they would derive slightly higher costs for a much smaller volume of fuel. A more detailed evaluation of the Baker and O'Brien cost estimates can be found in the Final RIA and RTC.

5. Supply of Nonroad, Locomotive and Marine Diesel Fuel

We have developed today's NRLM fuel program to minimize its impact on the supply of distillate fuel. For example: we have split the control of NRLM fuel to 15 ppm sulfur into two steps, providing 8 years of leadtime for the final step. We are proposing to provide flexibility to refiners through the availability of banking and trading provisions. We have provided relief for

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[213] Hirshfeld, David, MathPro, Inc., "Refining economics of diesel fuel sulfur standards," performed for the Engine Manufactuers Association, October 5, 1999.

small refiners and hardship relief for any qualifying refiner. We are also allowing 500 ppm diesel fuel generated in the distribution system to be sold as L&M fuel indefinitely.

In the NPRM, we evaluated four possible reasons why refiners might reduce their production of NRLM fuel: 1) chemical processing loses during the desulfurization process, 2) refiners might leave the NRLM fuel market, 3) refiners might stop operations altogether (i.e., shut down), and 4) refiners might remove certain blendstocks from the fuel pool to reduce desulfurization costs. In all four cases, we concluded that the answer was no, that the supply of NRLM fuel would likely remain adequate after implementation of the proposed fuel program. All of these findings started from the position that there would be adequate supply of diesel fuel after implementation of the 2007 highway diesel fuel program.

Several commenters, namely API and NPRA, took issue with the above four sets of arguments, as well as with our conclusion that refiners would not reduce NRLM fuel production. While not requesting any changes to the 2007 highway diesel fuel program, they reiterated previous concerns that supply shortages could occur under the highway diesel fuel program, even without the added challenge of producing low sulfur NRLM fuel. The primary basis for their comments was a study they had sponsored by Baker and O'Brien, which evaluated the costs and likely supply impacts of the proposal.

Baker and O'Brien evaluated two NRLM fuel scenarios: 1) a 15 ppm NRLM fuel cap starting in 2008, and 2) a 500 ppm NRLM fuel cap starting in 2008, followed by a 15 ppm cap only for nonroad fuel in 2010. First, Baker and O'Brien projected that 13 refineries with a total crude oil capacity of 971,000 barrels per day would close in response to the 2007 highway rule, roughly half in 2006 and half in 2010. (Total U.S. refining capacity is currently 16 million barrels per day.) Then Baker and O'Brien projected that adding a 15 ppm NRLM cap would cause all of the refineries shutting down in 2010 to close in 2008, plus one additional refinery (for a total of 14). Delaying the 15 ppm cap until 2010 and leaving L&M fuel at 500 ppm reduced the number of refineries projected to close in 2008, but did not change Baker and O'Brien's projection that 14 refineries would close by 2010. Given the fact that Baker and O'Brien projected the same number of refinery closures for scenarios #1 and #2, it is reasonable to assume that they would project similar results for today's final NRLM fuel program.

Table VI.A-6. – Projected Refinery Closures: API Sponsored Study by Baker and O'Brien

	No. of Refineries		Lost Crude Capacity (1000 bbl/day)	
	2008	**2010**	**2008**	**2010**
2007 Highway Fuel Program	8[214]	13	504	971
Plus One-Step 15 ppm NRLM Program	14	14	1043	1043
Plus Two-Step NRLM Program	12	14	924	1043

As a result of these refinery closures, Baker and O'Brien projected shortfalls in 15 and 500 ppm supply domestic refiners. The net shortfalls are shown in table VI.A-7 below. Baker and O'Brien stated that imports would have to make up the shortfall, with potentially high price impacts.

Table VI.A-7. – Projected Shortfall in Near-Term Diesel Fuel Supply (1000 barrels per day)

	15 ppm Fuel		500 ppm Fuel	
	2008	**2010**	**2008**	**2010**
2007 Highway Fuel Program	359	579	308	22
Plus One-Step 15 ppm NRLM Program	684	930	165	0
Plus Two-Step NRLM Program	351	639	481	82

To put these projected shortfalls in context, Baker and O'Brien projects total diesel fuel demand to be 3.3 million barrels per day in this timeframe (slightly lower than our own projection summarized above). Thus, these projected shortfalls total roughly 10-20 percent of total diesel fuel demand, which if true, would be very significant.

We evaluated the Baker and O'Brien study and their findings. Baker and O'Brien made very pessimistic assumptions regarding the likelihood that refiners would invest in desulfurization capacity. Their judgment that a refinery would close rather than invest also was apparently based only on what they perceived to be excessively high desulfurization costs. Baker and O'Brien presents no information regarding the location of these refineries, the competition they face, costs related to closing down, nor the profits that they would forego by closing. Baker and O'Brien also makes no mention of EPA's special provisions for refiners facing economic hardship, nor the small refiner provisions.

[214] Closure would occur at the beginning of the 15 ppm highway fuel program, or 2006.

We believe that it is not possible to project refinery closures without considering these factors. This is supported by comments made in response to our proposal of the 2007 highway diesel fuel program by Mathpro and the National Economic Research Associates. While we are aware of a couple of refineries that are being offered for sale and whose plans for producing low sulfur fuels are uncertain, we have no indications of as many as eight refineries closing in 2006 in response to the highway fuel program. In addition, despite uncertainties at a few refineries, refiners' pre-compliance reports for the highway fuel program indicate that they are planning to produce a sufficient supply of 15 and 500 ppm highway diesel fuel from 2006-2010. Therefore, there is ample evidence that Baker and O'Brien's projections for the highway diesel fuel program are overly pessimistic. It therefore appears likely that their projection that the NRLM fuel program will cause an additional refinery to close is also overly pessimistic. The reader is referred to the RTC for a summary of these comments and our detailed response to them.

In their comments, API also challenged our findings that refiners would maintain sufficient supply under the proposed NRLM fuel program. After a careful review of their comments and other information newly available since the NPRM, we do not believe that the arguments presented by API and NPRA justify changing our position that 1) chemical processing loses during the desulfurization process will be very small, 2) refiners will be unlikely to leave the NRLM fuel market, and 3) refiners are unlikely to shut down due to this rule.

Regarding point #1, the distillate material lost during desulfurization, our position is that the amount lost is small (two percent), and most of it is lost in the form of naphtha which can be blended into gasoline. Refiners can then adjust their mix of gasoline and distillate production to compensate. API claimed that in the winter, refiners were already at maximum distillate production and could not shift any additional heavy gasoline material into the distillate pool. API did not present any evidence that this is in fact the case. The fact that some refiners actually crack distillate material into gasoline makes it difficult to accept their position.

Regarding point #2, refiners leaving the NRLM fuel market, we argued that the only high sulfur distillate market remaining after 2007 was heating oil. Heating oil demand is flat or declining over time. We project that over 30 domestic refiners will still be able to produce heating oil after 2007, while other refiners will be able to produce sufficient quantities of NRLM fuel. If more refiners choose to produce heating oil, this market will be oversupplied and prices will drop significantly. Exporting high sulfur distillate is a possibility for some refiners, but this entails both transport costs, as well as relatively low prices overseas. Thus, a decision to not invest in NRLM fuel desulfurization has to be compared to the losses involved with the other options. API argued that some refiners face much higher desulfurization costs than others and this would lead those refiners to leave the NRLM fuel market. API did not estimate the losses that refiners would entail when they left the market. Studies performed for the highway fuel program indicate that these losses can be quite significant and inappropriate conclusions can be drawn if they are ignored. The highway program pre-compliance reports also indicate that some highway fuel refiners are planning on leaving the highway fuel market in 2006, while others will enter it for

the first time. Decisions to stay in or leave the NRLM fuel market are analogous. We have no reason to believe refiners would approach this market any differently than the highway market.

Regarding point #3, refineries shutting down, API again pointed towards the high costs faced by some refineries and the fact that a number of refineries have shut down over the past ten years. There have been a number of refinery closures over the past decade, though the trend has slowed considerably. API pointed towards two specific refineries which identified EPA's gasoline and diesel fuel sulfur controls as prime reasons for their shutting down. A closer look at these situations showed that the future capital investment related to the sulfur controls could have been a contributing factor. However, these refineries faced many other challenges and the timing of their closure (2000 and 2001, respectively) showed that the EPA rules were not the direct cause. The refiner involved did not approach EPA concerning any relief from the rules' requirements due to economic hardship. Thus, the connection between their closure and our sulfur controls appears even more tenuous.

Another example of a refinery closure unrelated to desulfurization costs was Shell's recent decision to close their refinery in Bakersfield, California. The reason was an insufficient supply of crude oil being produced locally.

Analogous to a decision to leave the NRLM fuel market, shutting down completely involves the total loss of any profit being made on the production of other fuels. API presented no economic calculations or projections showing that it would be in the best interest of any refiner to shut down rather than invest in NRLM fuel desulfurization.

This leaves point #4, that refiners might shift NRLM fuel blendstocks to other markets. This is really only an issue if the blendstocks are shifted to a non-distillate market.[215] The most likely place that NRLM fuel blendstocks might be shifted is to the residual fuel market. In particular, heavy (material with high densities and high distillation temperatures) LCO and LCGO could be shifted to residual fuel using existing refining equipment. The heavy portions of these two blendstocks contain the greatest concentrations of sulfur which is the most difficult to remove. Shifting this material to residual fuel, which currently does not have a sulfur standard, would reduce the size and cost of desulfurization equipment needed to meet a 15 ppm cap. Or, it would increase the volume of 15 ppm NRLM fuel which could be produced in an existing hydrotreater.

To evaluate this possibility, we estimated the cost of processing LCO (the worse of the two blendstocks) into 15 ppm diesel fuel for each domestic refinery. On average, desulfurizing LCO to 15 ppm sulfur cost 11.4 cents per gallon. However, in some cases, this cost reached 15 cents per gallon. The cost to process heavy LCO could be twice these amounts, since the

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[215] Shifting NRLM fuel blendstocks to heating oil is essentially the same as leaving the NRLM market, which was discussed under Point #2 above.

concentration of both total sulfur and the most difficult to remove sulfur are concentrated in the heaviest molecules.

A review of historic fuel prices showed that residual fuel is usually priced 25-30 cents per gallon less than diesel fuel. The highest incremental desulfurization costs for heavy LCO could potentially exceed this loss. Thus, a few refiners could find it economical to shift a portion of their LCO to the residual fuel market. The U.S. residual fuel market is small relative to the distillate fuel market, flat, and already being fulfilled. Worldwide, the residual fuel market is shrinking. Thus, it is unlikely that large volumes of LCO could leave the NRLM fuel market. However, we cannot rule out the possibility that some LCO, particularly that produced by capital-strapped refiners, could be shifted to residual fuel. To estimate the upper limit of this shift, we estimated the volume of heavy LCO produced by refineries whose LCO processing costs exceeded 12 cents per gallon and which were not owned by large, integrated oil companies or small refiners. This costly, heavy LCO represents 0.4 percent of total NRLM fuel demand, a very small volume. In this case, we would expect that this loss could easily be made up by increased imports of 15 ppm diesel fuel or domestic refiners facing lower 15 ppm NRLM fuel costs.

Overall, we expect that domestic refiners will continue to produce sufficient supplies of NRLM fuel. The greatest potential for near term loss will be due to the possibility that some refiners might decide to limit their capital investment in desulfurization capacity by shifting some heavy LCO to the residual fuel market.

Fuel-Only Control Programs: The potential supply impacts of a long-term 500 ppm NRLM cap would necessarily be less than those of today's final NRLM fuel program. In particular, desulfurizing "difficult" blendstocks, like LCO, to 500 ppm is not technically challenging and does not have the potential to cost more than would be lost in shifting LCO or heavy LCO to residual fuel. The capital investment to meet a 500 ppm cap is also half of that needed to meet a 15 ppm cap or less. Thus, the likelihood that raising this capital would prove difficult is much less. Given that we expect the final fuel program to have a very minimal impact on supply, a 500 ppm NRLM cap would be negligible.

The potential impact of a long-term 15 ppm NRLM cap is the same as that for today's final fuel program.

6. Fuel Prices

It is well known that it is difficult to predict fuel prices in absolute terms with any accuracy. The price of crude oil dominates the cost of producing gasoline and diesel fuel. Crude oil prices have varied by more than a factor of two in the past two years. In addition, unexpectedly warm or cold winters can significantly affect heating oil consumption, which affects the amount of gasoline produced and the amount of distillate material available for diesel fuel production. Economic growth, or its lack, affects fuel demand, particularly for diesel fuel.

Finally, both planned and unplanned shutdowns of refineries for maintenance and repairs can significantly affect total fuel production, inventory levels and resulting fuel prices.

Predicting the impact of any individual factor on fuel price is also difficult. The overall volatility in fuel prices limits the ability to determine the effect of a factor which changed at a specific point in time which might have led to the price change, as other factors continue to change over time. Occasionally, a fuel quality change, such as reformulated gasoline or a 500 ppm cap on diesel fuel sulfur content, only affects a portion of the fuel pool. In this case, an indication of the impact on price can be inferred by comparing the prices of the two fuels at the same general location over time. However, this is still only possible after the fact, and cannot be done before the fuel quality change takes place.

Because of these difficulties, EPA has generally not attempted to project the impact of its rules on fuel prices. However, in response to Executive Order 13211, we are doing so here.[216] To reflect the inherent uncertainty in making such projections, we developed three projections for the potential impact of the proposed fuel program on fuel prices. The range of potential long-term price increases are shown in table VI.A-8. (Due to their similarity, we have grouped the potential price impacts for similar quality fuels in the 2010-2012 and 2012-2014 time periods.) Short-term price impacts are highly volatile, as are short-term swings in absolute fuel prices, and much too dependent on individual refiners' decisions, unexpected shutdowns, etc. to be predicted even with broad ranges.

[216] Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use" (66 FR 28355, May 22, 2001).

Table VI.A-8. – Range of Possible Total Diesel Fuel Price Increases (cents per gallon) [a]

	Maximum Operating Cost	Average Total Cost	Maximum Total Cost
500 ppm Sulfur Cap: Nonroad, Locomotive and Marine Diesel Fuel (2007-2010)			
PADDs 1 and 3	2.9	1.8	4.5
PADD 2	3.0	2.5	3.8
PADD 4	3.7	3.5	6.1
PADD 5	1.2	1.5	1.5
15 ppm Sulfur Cap: NRLM Fuel (2010-2014)			
PADDs 1 and 3	5.6	5.7	9.4
PADD 2	7.3	7.4	10.8
PADD 4	7.9	12.6	13.6
PADD 5	4.5	5.1	5.2
15 ppm Sulfur Cap: NRLM Fuel (fully implemented program: 2014 +)			
PADDs 1 and 3	7.7	6.3	9.8
PADD 2	7.7	7.9	11.2
PADD 4	8.3	13.0	13.9
PADD 5	5.1	6.9	7.3

Notes: [a] At the current wholesale price of approximately $1.00 per gallon, these values also represent the percentage increase in diesel fuel price.

The lower end of the range assumes that prices within a PADD increased to reflect the highest operating cost increase faced by any refiner in that PADD (please see the Final RIA for details on this methodology). This refiner with the highest operating cost will not recover any of his invested capital, but all other refiners will recover some or all of their investment. In this case, the price of NRLM fuel will increase in 2007 by 1–3 cents per gallon, depending on the area of the country. In 2010, the price of 15 ppm NRLM fuel will increase a total of 3–7 cents per gallon. In 2014, under this pricing scenario, 15 ppm NRLM fuel prices will increase slightly, to 4–7 cents per gallon. The increase in 2014 is due to the expiration of the small refiner provisions, as well as

the fact that 500 ppm fuel created in the distribution system can no longer be sold to the land-based nonroad market.

The mid-range estimate of price impacts assumes that prices within a PADD increase by the average refining and distribution cost within that PADD, including full recovery of capital (at seven percent per annum before taxes). Lower cost refiners will recover more than their capital investment, while those with higher than average costs recover less. Under this assumption, the price of NRLM fuel will increase in 2007 by 1-3 cents per gallon, depending on the area of the country. In 2010, the price of 15 ppm NRLM fuel will increase a total of 4–11 cents per gallon. In 2014, under this pricing scenario, 15 ppm NRLM fuel prices will increase slightly, to 5–11 cents per gallon.

The upper end estimate of price impacts assumes that prices within a PADD increase by the maximum total refining and distribution cost of any refinery within that PADD, including full recovery of capital (at seven percent per annum before taxes). All other refiners will recover more than their capital investment. Under this assumption, the price of NRLM fuel will increase in 2007 by 1–4 cents per gallon, depending on the area of the country. In 2010, the price of 15 ppm NRLM fuel will increase a total of 4–13 cents per gallon. In 2014, under this pricing scenario, 15 ppm NRLM fuel prices will increase further to 6–13 cents per gallon. All these potential price impacts for 500 and 15 ppm fuel, relative to those projected in the NPRM, reflect the differences in cost estimates discussed above.

There are a number of assumptions inherent in all three of the above price projections. First, both the lower and upper limits of the projected price impacts described above assume that the refinery facing the highest compliance costs is currently the price setter in their market. This is a worse case assumption which is impossible to validate. Many factors affect a refinery's total costs of fuel production. Most of these factors, such as crude oil cost, labor costs, age of equipment, etc., are not considered in projecting the incremental costs associated with lower NRLM diesel fuel sulfur levels. Thus, current prices may very well be set in any specific market by a refinery facing lower incremental compliance costs than other refineries. This point was highlighted in a study by the National Economic Research Associates (NERA) for AAM of the potential price impacts of EPA's 2007 highway diesel fuel program.[217] In that study, NERA criticized the above referenced study performed by Charles River Associates, et. al. for API, which projected that prices will increase nationwide to reflect the total cost faced by the U.S. refinery with the maximum total compliance cost of all the refineries in the U.S. producing highway diesel fuel. To reflect the potential that the refinery with the highest projected compliance costs under the maximum price scenario is not the current price setter, we included the mid-point price impacts above. It is possible that even the lower limit price impacts are too high, if the conditions exist where prices are set based on operating costs alone. However, these

[217] "Potential Impacts of Environmental Regulations on Diesel Fuel Prices," NERA, for AAM, December 2000.

price impacts are sufficiently low that considering even lower price impacts was not considered critical to estimating the potential economic impact of this rule.

Second, we assumed in some cases that a single refinery's costs could affect fuel prices throughout an entire PADD. While this is a definite improvement over analyses which assume that a single refinery's costs could affect fuel prices throughout the entire nation, it is still conservative. High cost refineries are more likely to have a more limited geographical impact on market pricing than an entire PADD. In many cases, high cost refiners continue to operate simply because they are in a niche location where transportation costs limit competition.

Third, by focusing solely on the cost of desulfurizing NRLM diesel fuel, we assume that the production of NRLM diesel fuel is independent of the production of other refining products, such as gasoline, jet fuel and highway diesel fuel. However, this is clearly not the case. Refiners have some flexibility to increase the production of one product without significantly affecting the others, but this flexibility is quite limited. It is possible that the relative economics of producing other products could influence a refiner's decision to increase or decrease the production of NRLM diesel fuel under today's fuel program. It is this price response that causes fuel supply to match fuel demand. And, this response in turn could increase or decrease the price impact relative to those projected above.

Fourth, all three of the above price projections are based on the projected cost for U.S. refineries of meeting the NRLM fuel sulfur caps. Thus, these price projections assume that imports of NRLM fuel, which are currently significant in the Northeast, are available at roughly the same cost as those for U.S. refineries in PADDs 1 and 3. We have not performed any analysis of the cost of lower sulfur caps on diesel fuel produced by foreign refiners. However, there are reasons to believe that imports of 500 and 15 ppm NRLM diesel fuel will be available at prices in the ranges of those projected for U.S. refiners.

One recent study analyzed the relative cost of lower sulfur caps for Asian refiners relative to those in the U.S., Europe and Japan.[218] It concluded that costs for Asian refiners will be comparatively higher, due to the lack of current hydrotreating capacity at Asian refineries. This conclusion is certainly valid when evaluating lower sulfur levels for highway diesel fuels which are already at low levels in the U.S., Europe and Japan and for which refineries in these areas have already invested in hydrotreating capacity. It appears to be less valid when assessing the relative cost of meeting lower sulfur standards for NRLM fuels and heating oils which are currently at much higher sulfur levels in the U.S., Europe and Japan. All refineries face additional investments to remove sulfur from these fuels and so face roughly comparable control costs on a per gallon basis.

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[218] "Cost of Diesel Fuel Desulfurization In Asian Refineries," Estrada International Ltd., for the Asian Development Bank, December 17, 2002.

One factor arguing for competitively priced imports is the fact that refinery utilization rates are currently higher in the U.S. and Europe than in the rest of the world. The primary issue is whether overseas refiners will invest to meet tight sulfur standards for U.S., European and Japanese markets. Many overseas refiners will not invest, instead focusing on local, higher sulfur markets. However, many overseas refiners focus on exports. Both Europe and the U.S. are moving towards highway and nonroad diesel fuel sulfur caps in the 10–15 ppm range. Europe is currently and projected to continue to need to import large volumes of highway diesel fuel. Thus, it seems reasonable to expect that a number of overseas refiners will invest in the capacity to produce some or all of their diesel fuel at these levels. Many overseas refiners also have the flexibility to produce 10-15 ppm diesel fuel from their cleanest blendstocks, as most of their available markets have less stringent sulfur standards. Thus, there are reasons to believe that some capacity to produce 10–15 ppm diesel fuel will be available overseas at competitive prices. If these refineries were operating well below capacity, they might be willing to supply complying product at prices which only reflect incremental operating costs. This could hold prices down in areas where importing fuel is economical. However, it is unlikely that these refiners could supply sufficient volumes to hold prices down nationwide. Despite this expectation, to be conservative, in the refining cost analysis conducted earlier in this chapter, we assumed no imports of 500 ppm or 15 ppm NRLM diesel fuel. All 500 ppm and 15 ppm NRLM fuel was produced by domestic refineries. This raised the average and maximum costs of 500 ppm and 15 ppm NRLM diesel fuel and increased the potential price impacts projected above beyond what would have been projected had we projected that 5-10 percent of NRLM diesel fuel will be imported at competitive prices.

Fuel-Only Control Programs: We used the same methodology to estimate the potential price impacts for stand-alone 500 ppm and 15 ppm NRLM fuel programs. The potential price impacts of long-term 500 ppm and 15 ppm NRLM caps would be the same as those shown in table VI.A-8 above for the 500 ppm NRLM cap in 2007 and for the 15 ppm NRLM cap in 2014 and beyond, respectively.

B. Cost Savings to the Existing Fleet from the Use of Low Sulfur Fuel

We estimate that reducing fuel sulfur to 500 ppm would reduce engine wear and oil degradation to the existing nonroad diesel equipment fleet and that a further reduction to 15 ppm sulfur would result in even greater reductions. This reduction in wear and oil degradation would provide a dollar savings to users of nonroad equipment. The cost savings would also be realized by the owners of future nonroad engines that are subject to the standards in this proposal. As discussed below, these maintenance savings have been conservatively estimated to be greater than 3 cents per gallon for the use of 15 ppm sulfur fuel when compared to the use of today's unregulated nonroad diesel fuel. A summary of the range of benefits from the use of low-sulfur fuel is presented in Table VI.B-1.[219]

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[219] See Heavy-duty 2007 Highway Final RIA, Chapter V.C.5, and "Study of the Effects of Reduced Diesel Fuel Sulfur Content on Engine Wear," EPA report # 460/3-87-002, June 1987.

Table VI.B-1. – Engine Components Potentially Affected by Lower Sulfur Levels in Diesel Fuel [a]

Affected Components	Effect of Lower Sulfur	Potential Impact on Engine System
Piston Rings	Reduced corrosion wear	Extended engine life and less frequent rebuilds
Cylinder Liners	Reduced corrosion wear	Extended engine life and less frequent rebuilds
Oil Quality	Reduced deposits, reduced acid build-up, and less need for alkaline additives	Reduce wear on piston ring and cylinder liner and less frequent oil changes
Exhaust System (tailpipe)	Reduced corrosion wear	Less frequent part replacement
Exhaust Gas Recirculation System	Reduced corrosion wear	Less frequent part replacement

Notes: [a] The degree to which all of these benefits may occur for any specific engine will vary. For example, the impact of high sulfur fuel on piston rings, cylinder liners and oil quality are somewhat interdependent. To the extent an end-user lengthens the oil drain interval, the benefit of the low sulfur fuel on piston ring and cylinder liner wear will be lessened (though not eliminated). For users who do not alter oil drain intervals, the benefit of low sulfur fuel on extending piston ring and cylinder liner wear will be greater. The benefit of low sulfur fuel on reducing exhaust system and EGR system corrosion are independent of oil drain intervals.

The monetary value of these benefits over the life of the equipment will depend upon the length of time that the equipment operates on low-sulfur diesel fuel and the degree to which engine and equipment manufacturers specify new maintenance practices and the degree to which equipment operators change engine maintenance patterns to take advantage of these benefits. For equipment near the end of its life in the 2008 time frame, the benefits will be quite small. However, for equipment produced in the years immediately preceding the introduction of 500

ppm sulfur fuel, the savings would be substantial. Additional savings would be realized in 2010 when the 15 ppm sulfur fuel would be introduced

We estimate the single largest savings would be the impact of lower sulfur fuel on oil change intervals. The RIA presents our analysis for the oil change interval extension which would be realized by the introduction of 500 ppm sulfur fuel in 2007, as well as the additional oil extension which would be realized with the introduction of 15 ppm sulfur nonroad diesel fuel in 2010. As explained in the RIA, these estimates are based on our analysis of publically available information from nonroad engine manufacturers. Due to the wide range of diesel fuel sulfur which today's nonroad engines may see around the world, engine manufacturers specify different oil change intervals as a function of diesel sulfur levels. We have used this data as the basis for our analysis. Taken together, when compared to today's relatively high nonroad diesel fuel sulfur levels, we estimate the use of 15 ppm sulfur fuel will enable an oil change interval extension of 35 percent from today's products.

We received comments on our estimated maintenance savings primarily from a number of end-user groups (e.g., equipment dealers, equipment rental organizations, farming organizations). Several commenters believed our estimates were too high, and one commenter believed the estimate was too low. However, all of the commenters who believed our cost savings estimates were too high provided no data to support their comments, beyond unsubstantiated opinions, nor did they comment on EPA's substantial related technical analysis.
The commenter who suggested the estimates were too low provided an example cost estimate for existing oil change intervals which, if used in our analysis, would have resulted in an estimated cost savings 4 times EPA's estimate. We have not changed our estimate based on the comments we received.

We present here a fuel operating cost savings attributed to the oil change interval extension in terms of a cents per gallon operating cost. We estimate that an oil change interval extension of 31 percent, as would be enabled by the use of 500 ppm sulfur fuel in 2007, results in a fuel operating costs savings of 2.9 cents per gallon for the nonroad fleet. We estimate an additional cost savings of 0.3 cents per gallon for the oil change interval extension which would be enabled by the use of 15 ppm sulfur beginning in 2010. Thus, for the nonroad fleet as a whole, beginning in 2010 nonroad equipment users can realize an operating cost savings of 3.2 cents per gallon compared to today's engine. This means that the end cost to the typical user for 15 ppm sulfur fuel is approximately 3.8 cents per gallon (7.0 cent per gallon cost for fuel minus 3.2 cent per gallon maintenance savings). For a typical 100 horsepower nonroad engine this represents a net present value lifetime savings, excluding the higher fuel costs, of more than $500.

These savings will occur without additional new cost to the equipment owner beyond the incremental cost of the low-sulfur diesel fuel, although these savings are dependent on changes to existing maintenance schedules. Such changes seem likely given the magnitude of the savings. There are many mechanisms by which end-users could become aware of the opportunity to extend oil drain intervals. First, it is typical practice for engine and equipment manufacturers to issue

service bulletins regarding lubrication and fueling guidance for end-users.[220] Manufacturers provide these service bulletins to equipment dealerships and large equipment customers (such as rental companies). In addition, the equipment and end-user industries have a number of annual conferences which are used to share information, including information regarding appropriate engine and equipment maintenance practices. The end-user conferences are also designed to help specific industries and business reduce operating costs and maximize profits, which would include information on equipment maintenance practices. There are trade journals and publications which provide information and advice to their users regarding proper equipment maintenance. Finally, some nonroad users perform routine oil sample analysis in order to determine appropriate oil drain intervals, and in some cases to monitor overall engine wear rates in order to determine engine rebuild needs.[221] We have not estimated the value of the savings from all of the benefits listed in table VI.B-1, and therefore we believe the 3.2 cents per gallon savings is conservative as it only accounts for the impact of low sulfur fuel on oil change intervals. While some of these benefits are impacted by changes in oil change interval, a number are independent and not included in our cost savings estimate.

C. Engine and Equipment Cost Impacts

The following sections briefly discuss the various engine and equipment cost elements considered for this final rule and present the total costs we have estimated. The reader is referred to the RIA for a complete discussion. Estimated engine and equipment 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 new Tier 4 standards. The wide size variation (e.g., engines under 4 horsepower through engines above 2500 horsepower) and the broad application variation (e.g., lawn equipment through large mining trucks) that exists in the nonroad industry makes it difficult to present here an estimated cost for every possible engine and/or piece of equipment. Nonetheless, for illustrative purposes, we present some examples of engine and equipment cost impacts throughout this discussion. Note that the costs presented here are for those nonroad engines and equipment that are mobile nonroad equipment and are, therefore, subject to nonroad engine standards. These costs would not apply for that equipment that is stationary—some portion of some equipment segments such as generator sets, pumps, compressors—and not subject to nonroad engine standards. The analysis summarized here is presented in detail in chapter 6 of the RIA.

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[220] For example, Appendix A of EPA Memorandum "Estimate of the Impact of Low Sulfur Fuel on Oil Change Intervals for Nonroad Diesel Equipment" contains a service bulletin from a nonroad diesel engine manufacturer. Copy of memo available in EPA Air Docket A-2001-28, item II-A-194.

[221] For example, Appendix C of EPA Memorandum "Estimate of the Impact of Low Sulfur Fuel on Oil Change Intervals for Nonroad Diesel Equipment", which indicates Caterpillar recommends owners use Scheduled Oil Sampling analysis as the best means to for users to determine appropriate oil change intervals. Copy of memo available in EPA Air Docket A-2001-28, item II-A-194.

Note that the costs presented here do not reflect any savings that are expected to occur because of the engine ABT program and/or the equipment manufacturer transition program, which are discussed in sections III.A and B. These optional programs have the potential to provide significant savings for both engine and equipment manufacturers. As a result, we consider our cost estimates to be conservative, in the sense that they likely overstate total engine and equipment costs.

In general, the final engine and equipment cost analysis is the same as that done for our proposal. We have made the following changes:

- In response to a comment, we have increased our engine research and development (R&D) costs. In the proposal, we estimated the R&D expenditure that each engine manufacturer would make to comply with the Tier 4 standards. In response to the comment, we have refined that analysis and increased our estimate of engine R&D by roughly 50 percent. We did not receive any other comments with respect to our estimates for engine R&D.

- Because the final standards for engines above 750 horsepower have changed from the proposed standards, we have made changes to the engine R&D expenditures attributed to those engines. For costing purposes, the NO_X portion of the engine R&D expenditures are no longer shared by engines above 750 horsepower. This increases NO_X R&D attributed to other engines because a significant portion of engine R&D costs are costs shared across a wide range of products. We have also reduced the engine variable costs for engines above 750 horsepower since we are no longer projecting that NO_X adsorbers will be added to them.[222] This has no impact on the engine variable costs for other engines. We have

[222] In order to avoid inconsistencies in the way our emission reductions, and cost-effectiveness estimates are calculated, our cost methodology for engines and equipment relies on the same projections of new nonroad engine growth as those used in our emissions inventory projections. Our NONROAD emission inventory model includes estimates of future engine populations that are consistent with the future engine sales used in our cost estimates. The NONROAD model inputs include an estimate of what percentage of generator sets sold in the U.S. are "mobile" and, thus, subject to the nonroad standards, and what percentage are "stationary" and not subject to the nonroad standards. These percentages vary by power category and are documented in "Nonroad Engine Population Estimates," EPA Report 420-P-02-004, December 2002. For generator sets above 750 horsepower, NONROAD assumes 100 percent are stationary and, therefore, not subject to the new nonroad standards. For generator sets under 750 horsepower, we have assumed other percentages of mobile versus stationary. During our discussions with engine manufacturers after the proposal, it became apparent not only that our estimate for generator sets above 750 horsepower may not be correct and many are indeed mobile, but also that some of our estimates for generator sets above 750 horsepower may also not be correct and many more than we estimate may

also reduced the equipment redesign costs for engines above 750 horsepower since less redesign effort is projected to accommodate only a catalyzed diesel particulate filter (CDPF). This has no impact on the redesign costs of other equipment. Lastly, we have decreased the equipment variable costs for engines above 750 horsepower for the same reason as was done for engine variable costs.

- We have changed the engine operating costs for engines above 750 horsepower to reflect a different fuel economy impact than was associated with the proposed standards and to reflect the new timing for adding the CDPF and therefore incurring the maintenance costs associated with it.

- We have included costs for additional cooling on engines adding cooled EGR systems (engines of 25 to 50 horsepower and greater than 750 horsepower). These costs include the larger radiator and/or engine cooling fan that may be required on engines expected to add cooled EGR to meet the new standards. In the proposal, we had estimated the costs for the EGR system but not the costs for additional cooling.

- We have expressed all costs in 2002 dollars for the final rule rather than the proposal's use of 2001 dollars.

We received comments on other aspects of the proposed engine and equipment cost analysis that are not reflected in the final analysis. Some of the comments were:

- Some commenters claimed that we had underestimated costs for engines under 75 horsepower, and in the 75 to 100 horsepower range. For the engines under 75 horsepower, one commenter suggested the costs were higher than EPA estimated. Please see section 5.4.1 of the Summary and Analysis of Comments for a detailed discussion of the comments and our response. In the 75 to 100 horsepower range, one commenter suggested that we were incorrect in our assumption that those engines would have electronic fuel systems in the NRT4 baseline case, maintaining the electronic fuel systems would have to be added to these engines to comply with the Tier 4 standards and,

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indeed be mobile. If true, this increased percentage of mobile generator sets will be subject to the new nonroad standards. Unfortunately, we have not received sufficient data to make a conclusive change to the NONROAD model to include the potentially increased percentages of mobile generator sets and, therefore, for the above described purpose of maintaining consistency, we have not included their costs or their emissions reductions in our official estimates for this final rule (costs and emissions reductions for the current percentages in the NONROAD model are included in our estimates for the final rule). Instead, we present a sensitivity analysis in Chapter 8 of the RIA that includes both an estimate of the costs and emissions reductions that would result from including a higher percentage of generator sets as mobile equipment and subject to the new standards.

therefore, are a cost of the Tier 4 rule. From this premise, the commenter argued that the costs for 75 to 100 horsepower engines will be disproportionately high.

We disagree. In the proposal, we estimated that by 2012, engines in this power range would already have electronic fuel injection systems. This estimate was based on our engineering assessment of what technologies would be required to comply with the Tier 2 and Tier 3 emission standards, as well as technical discussions we had with engine manufacturers regarding future product plans. Therefore, the costs of these electronic fuel injection systems are not attributable to the Tier 4 rule. Our assessment at proposal is consistent with our projections in the Tier2/3 rulemaking where we estimated costs for electronic fuel injection systems as a cost of complying with those standards. In the preamble to the proposed Tier 4 rule, we presented estimates of the penetration of various engine technologies into several power ranges, including 75 to 100 horsepower, based on engine manufacturers' 2001 model year certification data. See 68 FR 28386, May 23, 2003. Since then, model year certification data for 2004 are available, and these data substantiate our earlier prediction. These model year 2004 data represent implementation of the Tier 2 standards so these data illustrate the technologies engine manufacturers are using to comply with those standards. These data show that nearly 20 percent of the engines that will be produced in this power range will have electronically controlled fuel systems, while the model year 2001 data show no engines in this power range had electronic fuel systems. This dramatic increase in electronics as a result of the Tier 2 standards, let alone the Tier 3 standards, gives us confidence that our projections regarding 2012 are reasonable. Section 4.1.4 of the RIA contains a detailed discussion of this information; see also the discussions in sections II.B.4.b.i and II.B.5 above. Thus, we continue to believe that we have properly attributed costs of electronic fuel systems to the Tier 3 rule, or, put another way, that the cost of an electronic fuel system is not a cost attributable to this Tier 4 rule for engines in the 75 to 100 horsepower category. Since the cost of electronic fuel systems is the essential difference in the costs we attribute to the Tier 4 rule for these engines versus the costs the commenter would attribute, we therefore disagree with the comment and believe our estimates to be reasonable. See also section II.A.5 above.

- One commenter took exception to our method of amortizing fixed costs over a period of years following implementation of the new standards. The commenter suggested that we used such a method to imply to the regulated industries that they would not only recover their investments but would also make a gain on those investments. This is not the case. We use this method of amortization, briefly described here and more fully in the RIA, only to reflect the time value of money so that we can get a more accurate estimate of the cost to the companies.

The Summary and Analysis of Comments document contains the details of all comments and our responses.

1. Engine Cost Impacts

Estimated engine costs are broken into fixed costs (for research and development, retooling, and certification), variable costs (for new hardware and assembly time), and life-cycle operating costs. Total operating costs include the estimated incremental cost for low-sulfur diesel fuel, any expected increases in maintenance costs associated with new emission control devices, any costs associated with increased fuel consumption, and any decreases in operating cost (i.e., maintenance savings) expected due to low-sulfur fuel. Cost estimates presented here represent an expected incremental cost of engines in the model year of their introduction. Costs in subsequent years will be reduced by several factors, as described below. All engine and equipment costs are presented in 2002 dollars since producer price indexes for 2003 were not available in time for use in this analysis.

a. Engine Fixed Costs

i. Engine and Emission Control Device R&D

The technologies described in Section II represent those technologies we believe will be used to comply with the Tier 4 emission standards. For many manufacturers, these technologies are part of an ongoing research and development effort geared toward compliance with the 2007 heavy-duty diesel highway emission standards. The engine manufacturers making R&D expenditures toward compliance with highway emission standards will have to undergo some additional R&D effort to transfer emission control technologies to engines they wish to sell into the nonroad market. These R&D efforts will allow engine manufacturers to develop and optimize these new technologies for maximum emission-control effectiveness with minimum negative impacts on engine performance, durability, and fuel consumption.

Many nonroad engine manufacturers are not part of the ongoing R&D effort toward compliance with highway emissions standards because they do not sell engines into the highway market. Nonetheless, these manufacturers are expected to benefit from the R&D work that has already occurred and will continue through the coming years through their contact with highway manufacturers, emission control device manufacturers, and the independent engine research laboratories conducting relevant R&D.

We project the use of several technologies for complying with the Tier 4 emission standards. We are projecting that NO_X adsorbers and catalyzed diesel particulate filters (CDPFs) will be the most likely technologies applied by industry to meet our new emissions standards for engines above 75 horsepower. The fact that these technologies are being developed for implementation in the highway market before the Tier 4 implementation dates, and the fact that engine manufacturers will have several years before implementation of the Tier 4 standards, ensures that the technologies used to comply with the nonroad standards will undergo significant development before reaching production. This ongoing development could lead to reduced costs in three ways. First, we expect research will lead to enhanced effectiveness for individual

technologies, allowing manufacturers to use simpler packages of emission control technologies than we would predict given the current state of development. Similarly, we anticipate that the continuing effort to improve the emission control technologies will include innovations that allow lower-cost production. Finally, we believe that manufacturers will focus research efforts on any drawbacks, such as fuel economy impacts or maintenance costs, in an effort to minimize or overcome any potential negative effects.

We anticipate that, in order to meet the Tier 4 standards, industry will introduce a combination of primary technology upgrades. Achieving very low NO_X emissions will require basic research on NO_X exhaust emission control technologies and improvements in engine management to take advantage of the new exhaust emission control system capabilities. The manufacturers are expected to address the challenge by optimizing the engine and new exhaust emission control system to realize the best overall performance. This will entail optimizing the engine and emission control system for both emissions and fuel economy performance in light of the presence of the new exhaust emission control devices and their ability to control pollutants previously controlled only via in-cylinder means or with exhaust gas recirculation. Since most research to date with exhaust emission control technologies for nonroad applications has focused on retrofit programs which typically add an exhaust emission control device without making engine control changes, there remains room for significant improvements by taking such a systems approach. The NO_X adsorber technology in particular is expected to benefit from re-optimization of the engine management system to better match the NO_X adsorber's performance characteristics. The majority of the dollars we have estimated for research is expected to be spent on developing this synergy between the engine and NO_X exhaust emission control systems. Therefore, for engines where we project use of both a CDPF and a NO_X adsorber (i.e., 75 to 750 horsepower), we have attributed two-thirds of the R&D expenditures to NO_X control, and one-third to PM control.

As we mentioned earlier, we have further refined our estimate of engine R&D costs since our proposal. We have taken these R&D costs and have broken them into two components. The first of these components estimates the corporate R&D applicable across all engine lines. The second of these estimates the engine line by engine line R&D cost. The estimates of line by line R&D correlate to power range—$1 million for under 75 horsepower engine lines, $3 million for 75 to 750 horsepower engine lines, and $6 million for above 750 horsepower engine lines. We estimated these expenditures based on the confidential information provided by the commenter and our analysis of that information. The end result is consistent with the commenter's suggested expenditure levels. We have applied these engine-line R&D estimates only where CDPFs and/or CDPF/NO_X adsorber systems are expected to be implemented (i.e., this R&D is not applied for the under 75 horsepower engines in 2008 because the R&D already estimated for complying with those standards should not require the same effort to tailor it to each engine). We have also applied these estimates only for those engines without a highway counterpart (note that only 16 of a total 133 nonroad engine lines had a highway counterpart).

In the 2007 HD highway rule, we estimated that each engine manufacturer would expend $36.1 million for R&D to redesign their engines and apply catalyzed diesel particulate filters (CDPF) and NO_X adsorbers.[223] For their nonroad R&D efforts on engines where we project that compliance will require CDPFs and NO_X adsorbers (i.e., 75 to 750 horsepower) and on greater than 750 horsepower engines requiring a CDPF, engine manufacturers that also sell into the highway market will incur some level of R&D effort but not at the level incurred for the highway rule. In many cases, the engines used by highway manufacturers in nonroad products are based on the same engine platform as those used in highway products. However, horsepower and torque characteristics are often different so some effort will have to be expended to accommodate those differences. For these manufacturers, we have estimated that they will incur an average R&D expense of $3.6 million[224] not including the nonroad engine line R&D noted above. This $3.6 million R&D expense will allow for the transfer of R&D knowledge from their highway experience to their nonroad engine product line. For the reasons stated above, two-thirds of this R&D is attributed to NO_X control and one-third to PM control for 75 to 750 horsepower engines; for engines above 750 horsepower, all of this R&D is attributed to PM control.

For those manufacturers that sell larger engines only into the nonroad market, and where we project those engines will add a CDPF and a NO_X adsorber (75 to 750 horsepower) or a CDPF-only (above 750 horsepower), we believe that they will incur an R&D expense nearing that incurred by highway manufacturers for the highway rule although not quite at the same level. Nonroad manufacturers will be able to learn from the R&D efforts already underway for both the highway rule and for the Tier 2 light-duty highway rule (65 FR 6698,February 10, 2000). This learning could be done via seminars, conferences, and contact with highway manufacturers, emission control device manufacturers, and the independent engine research laboratories conducting relevant R&D. Therefore, for these manufacturers, we have estimated an average expenditure of $25.3 million[225] not including the nonroad engine line R&D noted above. This lower number—$25.3 million versus $36.1 million in the highway rule—reflects the transfer of knowledge to nonroad manufacturers that will occur from the many stakeholders in the diesel industry. Two-thirds of this R&D is attributed to NO_X control and one-third to PM control.

Note that the $3.6 million and $25.3 million estimates represent our estimate of the average R&D expected by manufacturers to gain knowledge about the anticipated emission control devices. These estimates will be different for each manufacturer—some higher, some lower—depending on product mix and the number of engine lines in their product line.

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[223] In the 2007 rule, we estimated a value of $35 million in 1999 dollars. Here we have adjusted that value to express it in 2002 dollars.

[224] In the proposal, we estimated a value of $3.5 million in 1999 dollars. Here we have adjusted that value to express it in 2002 dollars.

[225] In the proposal, we estimated a value of $24.5 million in 1999 dollars. Here we have adjusted that value to express it in 2002 dollars.

For those engine manufacturers selling smaller engines that we project will add a CDPF-only (i.e., 25 to 75 horsepower engines in 2013), we have estimated that the average R&D they will incur will be roughly one-third that incurred by manufacturers conducting CDPF/NO_X adsorber R&D. We believe this is a good estimate because CDPF technology is further along in its development than is NO_X adsorber technology and, therefore, a 50/50 split is not appropriate. Using this estimate, the R&D incurred by manufacturers that already have been selling any engines into both the highway and the nonroad markets will be $1.2 million not including their nonroad engine line R&D, and the R&D for manufacturers selling engines into only the nonroad market will be roughly $8.3 million[226] not including their nonroad engine line R&D. All of this R&D is attributed to PM control.

For those engine manufacturers selling engines that we project will add only a DOC or make some engine-out modifications (i.e., engines under 75 horsepower in 2008), we have estimated that the average R&D they will incur will be roughly one-half the amount estimated for their CDPF-only R&D. Using this estimate, the R&D incurred by manufacturers selling any engines into both the highway and nonroad markets will be roughly $600,000, and the R&D for manufacturers selling engines into only the nonroad market will be roughly $4.2 million.[227] All of this R&D is attributed to PM control.

We have assumed that all R&D expenditures occur over a five year span preceding the first year any emission control device is introduced into the market. There is one exception to this assumption in that the expenditures for DOC-only R&D are assumed to occur over the four year span between the final rule and the 2008 standards. Where a phase-in exists (e.g., for NO_X standards on 75 to 750 horsepower engines), expenditures are assumed to occur over the five year span preceding the first year NO_X adsorbers will be introduced, and then to continue during the phase-in years. The expenditures will be incurred in a manner consistent with the phase-in of the standard. All R&D expenditures are then recovered by the engine manufacturer over an identical time span following the introduction of the technology, with the exception that expenditures for DOC-only R&D are recovered over a five year span rather than a four year span. We assume an opportunity cost of capital of seven percent for all R&D. We have apportioned these R&D costs across all engines that are expected to use these technologies, including those sold in other countries or regions that are expected to have similar standards. We have estimated the fraction of the U.S. sales to this total sales at 42 percent. Therefore, we have attributed this amount to U.S. sales. Note that all engine R&D costs for engines under 25 horsepower have been attributed to U.S. sales since other countries are not expected to have similar standards on these engines.

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[226] In the proposal, we estimated values of $1.2 million and $8 million in 1999 dollars. Here we have adjusted those values to express them in 2002 dollars.

[227] In the proposal, we estimated values of $600,000 and $4 million in 1999 dollars. Here we have adjusted those values to express them in 2002 dollars.

Using this methodology, we have estimated the total R&D expenditures attributable to the new standards at $323 million with $206 million spent on corporate R&D and $118 million spent on engine line R&D. For comparison, our proposal estimated $199 million for basic R&D and none for engine line R&D. The amount for corporate R&D is higher here solely due to the change to 2002 dollars.

ii. Engine-Related Tooling Costs

Once engines are ready for production, new tooling will be required to accommodate the assembly of the new engines. We have indicated below where our tooling cost estimates have changed from the proposal. In the 2007 highway rule, we estimated approximately $1.65 million per engine line for tooling costs associated with CDPF/NO_X adsorber systems.[228] For the nonroad Tier 4 standards, we have estimated that nonroad-only manufacturers will incur the same $1.65 million per engine line requiring a CDPF/NO_X adsorber system and that these costs will be split evenly between NO_X control and PM control. For those systems requiring only a CDPF, we have estimated one-half that amount, or $825,000 per engine line. For those systems requiring only a DOC or some engine-out modifications, we have applied a one-half factor again, or $412,500 per engine line. Tooling costs for CDPF-only and for DOC engines are attributed solely to PM control. None of these estimates have changed since our proposal, with the exception of being expressed in 2002 dollars. We received no comments on our tooling cost estimates.

For those manufacturers selling into both the highway and nonroad markets, we have estimated one-half the baseline tooling cost, or $825,000, for those engine lines requiring a CDPF/NO_X adsorber system. We believe this is reasonable since many nonroad engines are produced on the same engine line with their highway counterparts. For such lines, we believe very little to no tooling costs will be incurred. For engine lines without a highway counterpart, something approaching the $1.65 million tooling cost is applicable. For this analysis, we have assumed a 50/50 split of engine product lines for highway manufacturers and, therefore, a 50 percent factor applied to the $1.65 million baseline. These tooling costs will be split evenly between NO_X control and PM control. For engine lines under 75 horsepower and above 750 horsepower, we have used the same tooling costs as the nonroad-only manufacturers because these engines tend not to have a highway counterpart. Therefore, for those engine lines requiring only a CDPF (i.e., those between 25 and 75 horsepower and those above 750 horsepower), we have estimated a tooling cost of $825,000. Note that this is a change from the proposal for engines above 750 horsepower; the proposal used the full $1.65 million since both a CDPF and a NO_X adsorber were being projected. The tooling costs for DOC and/or engine-out engine lines has also been estimated to be $412,500. Tooling costs for CDPF-only and for DOC engines are attributed solely to PM control. With the exception of the greater than 750 horsepower change, none of these tooling estimates have changed since our proposal, with the exception of being expressed in 2002 dollars.

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[228] In the 2007 rule, we estimated a value of $1.6 million in 1999 dollars. Here we have adjusted that value to express it in 2002 dollars.

We expect engines in the 25 to 50 horsepower range to apply EGR systems to meet the Tier 4 NO_X standards for 2013. For these engines, we have included an additional tooling cost of $41,300 per engine line, consistent with the EGR-related tooling cost estimated for 50-100 horsepower engines in our Tier 2/3 rulemaking. The EGR tooling costs are applied equally to all engine lines in that horsepower range regardless of the markets into which the manufacturer sells. We have applied this tooling cost equally because engines in this horsepower range tend not to have highway counterparts. Tooling costs for EGR systems are attributed solely to NO_X control.

We have also estimated some tooling costs for engines above 750 horsepower to meet the 2011 standards. We have estimated this amount at ten times the amount for 25 to 50 horsepower engines, or $413,000 per engine line. This cost was not in the proposal since NO_X adsorbers were being projected for engines above 750 horsepower. We have applied this tooling to all engine lines above 750 horsepower, regardless of what markets into which a manufacturer sells, since such engines clearly have no highway counterpart. For the purpose of allocating costs, we have attributed this cost entirely to NO_X control. Note that there is a new 2011 PM standard for engines above 750 horsepower. However, we believe that PM standard could be met via engine-out control which would result in no new tooling costs associated with that standard.

We have applied all the above tooling costs to all manufacturers that appear to actually make engines. We have not eliminated joint venture manufacturers because these manufacturers will still need to invest in tooling to make the engines even if they do not conduct any R&D. We have assumed that all tooling costs are incurred one year in advance of the new standard and are recovered over a five year period following implementation of the new standard; all tooling costs include a capital opportunity cost of seven percent. As done for R&D costs, we have attributed a portion of the tooling costs to U.S. sales and a portion to sales in other countries expected to have similar levels of emission control. Note that all engine tooling costs for under 25 horsepower engines have been attributed to U.S. sales since other countries are not expected to have similar standards on these engines. More information is contained in chapter 6 of the RIA.

Using this methodology, we estimate the total tooling expenditures attributable to the new Tier 4 standards at $74 million. For comparison, our proposal estimated $67 million. The higher value here is a result of: expressing values in 2002 dollars rather than 2001 dollars; attributing all under 25 horsepower tooling costs to U.S. sales while the proposal attributed 42 percent of those costs to U.S. sales; and, above 750 horsepower tooling is slightly higher because of the proposal's phase-in (50/50/50/100) of one set of standards while the final rule has two sets of standards.

iii. Engine Certification Costs

The comments we received with respect to our estimated certification costs noted that we had underestimated costs associated with new test procedures, especially transient testing for engines above 750 horsepower. For the final rule, we have tripled the costs associated with new test procedures. Because we are not finalizing transient test procedures for engines above 750

horsepower, comments about the cost of these engines certifying using the transient test are now moot.

Manufacturers will incur more than the normal level of certification costs during the first few years of implementation because engines will need to be certified to the new emission standards using new test procedures (at least in some instances). Consistent with our recent standard setting regulations, we have estimated engine certification costs at $60,000 per new engine certification to cover existing testing and administrative costs.[229] The $60,000 certification cost per engine family was used for 25 to 75 horsepower engines certifying to the 2008 standards. For 25 to 75 horsepower engines certifying to the 2013 standards, and for 75 to 750 horsepower engines certifying to their new standards, we have added costs to cover the new test procedures for nonroad diesel engines (e.g., the transient test, the NTE);[230] these costs are estimated at $31,500 per engine family.[231] For engines under 25 horsepower, we have assumed (for cost purposes) that all engines will certify to the transient test and the NTE in 2008. We believe manufacturers may choose to do this rather than certifying all engines again in 2013 when the transient test and NTE requirements actually begin for those engines. This assumption results in higher certification costs in 2008 than if these engines certified only to the steady-state standard. However, we believe manufacturers may choose to do this because it would avoid the need to recertify all engines under 25 horsepower again in 2013. These certification costs – whether it be the $60,000 or the $91,500 per engine family – apply equally to all engine families for all manufacturers regardless of into what markets the manufacturer sells. For engines above 750 horsepower, the certification costs used were $87,000 per family since these engines will not be certifying over the new transient test procedure. We have applied these certification costs to all U.S. sold engine families and then spread the total over U.S. sales. In other words, we have not

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[229] In the proposal we added a certification fee to this cost. In the final rule we have not included the certification fee because that cost will be accounted for in the certification fees rulemaking (see 67 FR 51402 for the proposed rule). Including in the proposal was essentially double counting that fee. Similarly, if we were to include it in this final rule, we would be double counting that fee.

[230] Note that the transport refrigeration unit (TRU) test cycle is an optional duty cycle for steady-state certification testing specifically tailored to the operation of TRU engines. Likewise, the ramped modal cycles are available test cycles that can be used to replace existing steady-state test requirements for nonroad constant-speed engines, generally. Manufacturers of these engines who opt to use one of these test cycles would incur no new costs above those estimated here and may incur less cost.

[231] Note that the proposal incorrectly used a value of $10,500 for costs associated with the new test procedures. Here, we have corrected this error by using a value of $31,500. Note also that the proposal erroneously did not include certification costs associated with transient testing and the NTE for engines under 25 horsepower. We have corrected that error in the final analysis.

presumed that certification conducted for U.S. engines would fulfill the certification requirements of other countries and have, therefore, not spread total costs over engine sales outside the U.S..

Applying these costs to each of the 665 engine families as they are certified to a new emissions standard results in total costs of $91 million expended during implementation of the Tier 4 standards. These costs are attributed to NO_X and PM control consistent with the phase-in of the new emissions standards – where new NO_X and PM standards are introduced together, the certification costs are split evenly; where only a new PM standard is introduced, the certification costs are attributed to PM only; where a NO_X phase-in becomes 100 percent in a year after full implementation of a PM standard, the certification costs are attributed to NO_X only. All certification costs are assumed to occur one year prior to the new emission standard and are then recovered over a five year period following compliance with the new standard; all certification costs include a capital opportunity cost of seven percent. For comparison, our proposal estimated certification costs at $72 million. The increase here is a result of using a higher cost associated with the new test procedures than was used in the proposal.

We also received comment that we should estimate certification costs based on use of the ABT program rather than based on the phase-in. Doing this would result in higher certification costs because all engine families would be certified in year one of the phase-in and all families would again be certified in the final year of the phase-in. In contrast, since we have based certification costs on the phase-in, all engine families are certified in year one (PM standards have no phase-in) and only half are again certified in the final year (the 50 percent not meeting the new NO_X standard in year one). We have chosen not to estimate certification or any costs based on use of the ABT program (or the TPEM program) since it is so difficult to predict how this program will be used. Furthermore, we must remain consistent throughout our cost analysis so that, if we estimated certification costs based on use of the ABT program, we should also base engine variable costs and equipment variable costs on use of the ABT program. Doing so, we believe, would decrease engine variable costs since that is the primary reason manufacturers choose to make use of the ABT program. Since engine variable costs, as discussed below, are a much greater fraction of the overall program costs, we believe that we are being conservative by generating our costs based on use of the phase-in. Therefore, we believe that use of the ABT program (and the TPEM program) will provide substantial net savings to industry even though widespread use of ABT might cause certification costs to be higher.

b. Engine Variable Costs

This section summarizes the detailed analysis presented in chapter 6 of the RIA. For our analysis, we have used the 2002 annual average costs for platinum and rhodium (the two platinum group metals (PGMs) we expect will be used) because we believe they represent a better estimate of the cost for PGM than other metrics. In the RIA, we present a cost sensitivity that estimates the recovery value of precious metals returned to the open market upon retirement of an aftertreatment device. We present that analysis to gauge the true social cost of these devices when new.

We have not made any changes to our engine variable costs as a result of public comments. Some commenters (engine manufacturers) claimed that we had underestimated these costs but did not provide any detailed information about where they believed we had erred or what they believed the costs should be. Other commenters (emission control device manufacturers) claimed that we had done a fair job with our estimates. Some commenters (equipment manufacturers) claimed that our assumptions with respect to baseline engine configurations were not accurate. However, as discussed earlier, based on our own engineering judgement and the positive comments of the engine manufacturers—who we consider a better source for such information than equipment manufacturers since engine manufacturers are the directly affected entities—we have maintained our original assumptions for baseline engine configurations. Further, our assumed Tier 4 baseline engine configurations are consistent with our assumed compliant technology packages for T2/3, and those packages included the things equipment manufacturers are claiming will not be present in the Tier 4 baseline. As a result, we have already considered the costs associated with reaching our Tier 4 baseline engine configurations in the context of the T2/3 rule.

We have made changes to engine variable costs to remain consistent with the final program – i.e., we have changed our greater than 750 horsepower cost estimates since the final standards differ from those that were proposed. We have also changed the costs by expressing them in 2002 dollars rather than 2001 dollars.[232]

i. NO_X Adsorber System Costs

The NO_X adsorber system that we are anticipating will be used to comply with Tier 4 engine standards will be the same as that used for highway applications. In order for the NO_X adsorber to function properly, a systems approach that includes a reductant metering system and control of engine A/F ratio is also necessary. Many of the new air handling and electronic system technologies developed in order to meet the Tier 2/3 nonroad engine standards can be applied to accomplish the NO_X adsorber control functions as well (these costs were accounted for in our T2/3 rule). Some additional hardware for exhaust NO_X or O_2 sensing and for fuel metering will likely be required. The cost estimates include a DOC for clean-up of hydrocarbon emissions that occur during NO_X adsorber regeneration events. We have also estimated that warranty costs will increase due to the application of this new hardware. Chapter 6 of the RIA contains the details for how we estimated costs associated with the new NO_X control technologies required to meet the Tier 4 emission standards. These costs are estimated to increase engine costs by roughly $670 in the near-term for a 150 horsepower engine, and $2,040 in the near-term for a 500 horsepower

[232] Note that the change to 2002 dollars had different effects on different pieces of hardware. We have used two different PPI adjustments in the analysis: one for motor vehicle catalytic converters which was used to adjust costs for DOCs, NO_X adsorbers, and CDPFs; and another for motor vehicle parts and accessories which was used for all other pieces of hardware. The former of these adjustments actually caused costs to decrease relative to the proposal while the latter caused costs to increase slightly.

engine. In the long-term, we estimate these costs to be $550 and $1,650 for the 150 horsepower and 500 horsepower engines, respectively. These costs may differ slightly from the proposal due to the adjustments to 2002 dollars. Note that we have estimated costs for all engines in all horsepower ranges, and these estimates are presented in detail in the RIA. Throughout this discussion of engine and equipment costs, we present costs for a 150 and a 500 horsepower engine for illustrative purposes.

ii. Catalyzed Diesel Particulate Filter (CDPF) Costs

CDPFs can be made from a wide range of filter materials including wire mesh, sintered metals, fibrous media, or ceramic extrusions. The most common material used for CDPFs for heavy-duty diesel engines is cordierite. Here we have based our cost estimates on the use of silicon carbide (SiC) even though it is more expensive than other filter materials.[233] We estimate that the CDPF systems will add $760 to engine costs in the near-team for a 150 horsepower engine and $2,710 in the near-term for a 500 horsepower engine. In the long-term, we estimate these CDPF system costs to be $580 and $2,070 for the 150 horsepower and the 500 horsepower engines, respectively. These costs may differ slightly from the proposal due to the adjustments to 2002 dollars.

iii. CDPF Regeneration System Costs

Application of CDPFs in nonroad applications may present challenges beyond those of highway applications. For this reason, we anticipate that some additional hardware beyond the diesel particulate filter itself may be required to ensure that CDPF regeneration occurs. For some engines this may be new fuel control strategies that force regeneration under some circumstances, while in other engines it might involve an exhaust system fuel injector to inject fuel upstream of the CDPF to provide necessary heat for regeneration under some operating conditions. We estimate the near-term costs of a CDPF regeneration system to be $200 for a 150 horsepower engine and $330 for a 500 horsepower engine. In the long-term, we estimate these costs at $150 and $250, respectively. These costs may differ slightly from the proposal due to the adjustments to 2002 dollars.

iv. Closed-Crankcase Ventilation System (CCV) Costs

Today's final rule eliminates the exemption that allows turbo-charged nonroad diesel engines to vent crankcase gases directly to the environment. Such engines are said to have an

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[233] This is particularly true with respect to engines above 750 horsepower where we believe that manufacturers may in fact use a wire mesh substrate rather than the SiC substrate we have costed and, indeed, we have based the level of the 2015 PM standard on this use of wire mesh substrates (see section II.B.3.b). We have chosen to remain conservative in our cost estimates by assuming use of a SiC substrate for all engines.

open crankcase system. We project that this requirement to close the crankcase on turbo-charged engines will force manufacturers to rely on engineered closed crankcase ventilation systems that filter oil from the blow-by gases prior to routing them into either the engine intake or the exhaust system upstream of the CDPF. We have estimated the initial cost of these systems to be roughly $30 for low horsepower engines and up to $90 for very high horsepower engines. These costs are incurred only by turbo-charged engines because today's naturally aspirated engines already have CCV systems. These costs may differ slightly from the proposal due to the adjustments to 2002 dollars.

v. Variable Costs for Engines Below 75 Horsepower and Above 750 Horsepower

The Tier 4 program includes standards for engines under 25 horsepower that begin in 2008, and two sets of standards for 25 to 75 horsepower engines – one set that begins in 2008 and another that begins in 2013.[234] The 2008 standards for all engines under 75 horsepower are of similar stringency and are expected to result in use of similar technologies (i.e., the possible addition of a DOC). The 2013 standards for 25 to 75 horsepower engines are considerably more stringent than the 2008 standards and are expected to force the addition of a CDPF along with some other engine hardware to enable the proper functioning of that new technology. More detail on the mix of technologies expected for all engines under 75 horsepower is presented in section II.B.4 and 5. As discussed there, if changes are needed to comply, we expect manufacturers to comply with the 2008 standards through either engine-out improvements or through the addition of a DOC. From a cost perspective, we have projected that engines will add a DOC. Presumably, the manufacturer will choose the least costly approach that provides the necessary reduction. If engine-out modifications are less costly than a DOC, our estimate here is conservative. If the DOC proves to be less costly, then our estimate is representative of what most manufacturers will do. Therefore, we have assumed that, beginning in 2008, all engines below 75 horsepower add a DOC. Note that this estimate is made more conservative since we have assumed this cost for all engines when, in fact, some engines below 75 horsepower currently meet the Tier 4 PM standard (for 2008) and will not, therefore, incur any incremental costs to meet it. We have estimated this added hardware to result in an increased engine cost of $143 in the near-term and $136 in the long-term for a 30 horsepower engine. These costs may differ slightly from the proposal due to the adjustments to 2002 dollars.

We have also projected that some engines in the 25 to 75 horsepower range will have to upgrade their fuel systems to accommodate the CDPF. We have estimated the incremental costs for these fuel systems at roughly $870 for a three cylinder engine in the 25–50 horsepower range, and around $450 for a four cylinder engine in the 50-75 horsepower range. This difference reflects a different base fuel system, with the smaller engines assumed to have mechanical fuel

[234] We refer here to PM standards. There also is a NO_X+NMHC standard for 25-50 horsepower engines that takes effect in 2013 and is equivalent to the Tier 3 NO_X+NMHC standard for 50-75 horsepower engines (see section II.A).

systems and the larger engines assumed to already be electronic. The electronic systems will incur lower costs because they already have the control unit and electronic fuel pump. Also, we have assumed these fuel changes will occur for only direct injection (DI) engines; indirect injection engines (IDI) are assumed to remain IDI but to add more hardware as part of their CDPF regeneration system to ensure proper regeneration under all operating conditions. Such a regeneration system, described above, is expected to cost roughly twice that expected for DI engines, or around $320 for a 30 horsepower IDI engine versus $160 for a DI engine. These costs may differ slightly from the proposal due to the adjustments to 2002 dollars.

We have also projected that engines in the 25–50 horsepower range will add cooled EGR to comply with their new NO_X standard in 2013. Additionally, we have estimated, for cost purposes, that engines above 750 horsepower will add cooled EGR to comply with their new NO_X standard in 2011. This represents a conservative estimate since we do not necessarily anticipate that cooled EGR will be applied to all, if any, engines above 750 horsepower. Nonetheless, we do expect some changes to be made (most probably some form of engine-out emission control) and, consistent with our approach to costing DOCs for engines below 75 horsepower in 2008, we have conservatively costed cooled EGR for engines above 750 horsepower in 2011. We have estimated that the EGR system will add $100 in the near-term and $70 in the long-term to the cost of a 30 horsepower engine, and $550 and $420, respectively, for engines above 750 horsepower. These costs may differ slightly from the proposal due to the adjustments to 2002 dollars. To these costs, we have added costs associated with additional cooling that may be needed to reject the heat generated by the cooled EGR system or other in-cylinder technologies. These costs were not included in the proposal. Such additional cooling might take the form of a larger radiator and/or a larger or more powerful cooling fan. Based on cost estimates from our Nonconformance Penalty rule (67 FR 51464), we have estimated that the costs associated with additional cooling will add $40 in the near-term and $30 in the long-term to the cost of a 30 horsepower engine, and $710 in the near-term and $560 in the long-term for engine above 750 horsepower. Note that we are also projecting use of a CDPF for engines above 750 horsepower, as was discussed above.

We believe there are factors that will cause variable hardware costs to decrease over time, making it appropriate to distinguish between near-term and long-term costs. Research in the costs of manufacturing has consistently shown that as manufacturers gain experience in production, they are able to apply innovations to simplify machining and assembly operations, use lower cost materials, and reduce the number or complexity of component parts.[235] Our analysis, as described in more detail in the RIA, incorporates the effects of this learning curve by projecting that the variable costs of producing the low-emitting engines decreases by 20 percent starting with the third year of production. For this analysis, we have assumed a baseline that represents such learning already having occurred once due to the 2007 highway rule (i.e., a 20 percent reduction in emission control device costs is reflected in our near-term costs). We have then applied a single learning step from that point in this analysis. Additionally, manufacturers are expected to apply

[235] For example, see, "Learning Curves in Manufacturing," Linda Argote and Dennis Epple, *Science*, February 23, 1990, Vol. 247, pp. 920-924.

ongoing research to make emission controls more effective and to have lower operating costs over time. However, because of the uncertainty involved in forecasting the results of this research, we conservatively have not accounted for it in this analysis.

c. Engine Operating Costs

We are projecting that a variety of new technologies will be introduced to enable nonroad engines to meet the new Tier 4 emissions standards. Primary among these are advanced emission control technologies and low-sulfur diesel fuel. The technology enabling benefits of low-sulfur diesel fuel are described in Section II, and the incremental cost for low-sulfur fuel is described in section VI.A. The new emission control technologies are themselves expected to introduce additional operating costs in the form of increased fuel consumption and increased maintenance demands. Operating costs are estimated in the RIA over the life of the engine and are expressed in terms of cents/gallon of fuel consumed. In section VI.C.3, we present these lifetime operating costs as a net present value (NPV) in 2002 dollars for several example pieces of equipment.

Total operating cost estimates include the following elements: the change in maintenance costs associated with applying new emission controls to the engines; the change in maintenance costs associated with low sulfur fuel such as extended oil change intervals; the change in fuel costs associated with the incrementally higher costs for low sulfur fuel, and the change in fuel costs due to any fuel consumption impacts associated with applying new emission controls to the engines. This latter cost is attributed to the CDPF and its need for periodic regeneration which we estimate may result in a one percent fuel consumption increase where a NO_X adsorber is also applied, or a two percent fuel consumption increase where no NO_X adsorber is applied (refer to chapter 6, section 6.2.3.3 of the RIA). Maintenance costs associated with the new emission controls on the engines are expected to increase since these devices represent new hardware and, therefore, new maintenance demands. For CDPF maintenance, we have used a maintenance interval of 3,000 hours for smaller engines and 4,500 hours for larger engines and a cost of $65 through $260 for each maintenance event. For closed-crankcase ventilation (CCV) systems, we have used a maintenance interval of 675 hours for all engines and a cost per maintenance event of $8 to $48 for small to large engines. Offsetting these maintenance cost increases will be a savings due to an expected increase in oil change intervals because low sulfur fuel will be far less corrosive than is current nonroad diesel fuel. Less corrosion will mean a slower acidification rate (i.e., less degradation) of the engine lubricating oil and, therefore, more operating hours between needed oil changes. As discussed in section VI.B, the use of 15 ppm sulfur fuel can extend oil change intervals by as much as 35 percent for both new and existing nonroad engines and equipment. We have used a 35 percent increase in oil change interval along with costs per oil change of $70 through $400 to arrive at estimated savings associated with increased oil change intervals.

These operating costs are expressed as a cent/gallon cost (or savings). As a result, operating costs are directly proportional to the amount of fuel consumed by the engine. We have estimated these operating costs—fuel-related refining and distribution costs, maintenance related

costs, and fuel economy impacts—to be 5.4 cents/gallon for a 150 horsepower engine and 6.5 cents/gallon for a 500 horsepower engine. More detail on operating costs can be found in Chapter 6 of the RIA.

The existing fleet will also benefit from lower maintenance costs due to the use of low sulfur diesel fuel. The operating costs for the existing fleet are discussed in section VI.B. We did receive comments with respect to our oil change maintenance savings estimates. These comments were address in section VI.B. We received no comments on our CDPF and CCV maintenance costs or our CDPF regeneration costs.

2. Equipment Cost Impacts

In addition to the costs directly associated with engines that incorporate new emission controls to meet new standards, costs will increase due to the need to redesign the nonroad equipment in which these engines are used. Such redesigns will probably be necessary due to the expected addition of new emission control systems, but could also occur if the engine has a different shape or heat rejection rate, or is no longer made available in the configuration previously used. We have accounted for these potential changes in establishing the lead time for the Tier 4 emissions standards. The transition flexibility provisions for equipment manufacturers that are included in this final rule are an element of that lead time. These flexibility provisions are described in detail in section III.B.

In assessing the economic impact of the new emission standards, EPA has made a best estimate of the modifications to equipment that relate to packaging (installing engines in equipment engine compartments). The incremental costs for new equipment will be comprised of fixed costs (for redesign to accommodate new emission control devices) and variable costs (for new equipment hardware to affix the new emission control devices and for labor to install those emission control devices). Note that the fixed costs do not include certification costs because the equipment is not certified to emission standards. The engine is certified by the engine manufacturer; therefore, the related certification costs are counted as an engine fixed cost. We have also attributed all changes in operating costs (e.g., additional maintenance) to the cost estimates for engines. Included in section VI.C.3 is a discussion of several example pieces of equipment (e.g., skid/steer loader, dozer, etc.) and the costs we have estimated for these specific example pieces of equipment Full details of our equipment cost analysis can be found in chapter 6 of the RIA. All costs are presented in 2002 dollars.

We have made only limited changes relative to the proposal with respect to our estimated equipment costs, as discussed below. We did receive comment that we underestimated costs for equipment redesign and for markups on equipment variable costs. The commenters making these claims relative to equipment redesign costs tended to be those that have relative high equipment sales volumes. Such manufacturers tend to expend levels higher than we estimated in our proposal for equipment redesign because they sell into highly competitive markets and they can spread costs over many units. However, some equipment manufacturers we have met with, most

notably those with small sales volumes, do not appear to expend nearly the level we estimated in the proposal. These manufacturers tend to sell into markets with few competitors, produce machines by hand, and expend less redesign effort relative to a high sales volume manufacturer.[236] Our goal in the proposal was to estimate the redesign costs spent by industry (i.e., the average cost per piece of equipment multiplied by all equipment resulting in an estimated total industry cost), rather than estimating the maximum cost to be spent by any particular manufacturer. As a result, our equipment redesign estimates per model may be too low for some manufacturers, but they are also too high for others. We believe this cost methodology provides as accurate an estimate as can be made. We have used the same methodology for the final cost estimates presented here.

As for the comments with respect to equipment variable costs, we did indeed include a markup of 29 percent and disagree with the commenter that a two-to-one markup would be more appropriate. Such a high markup on equipment variable costs is not sustainable in a competitive market, at least on average, and the commenter provided no data nor study that supported the comment.

We have made minor changes to the proposed numbers to express them in 2002 dollars and to reflect where the program has changed (i.e., greater than 750 horsepower mobile machines). We have also attributed all under 25 horsepower redesign costs to U.S. sales since we do not expect other countries to have similar emission standards for these engines/equipment. Lastly, we have corrected some minor errors made in the proposal in determining motive versus non-motive models and determining the number of unique equipment models needing redesign. We now estimate that a total of over 4,500 equipment models will be redesigned as compared to the proposal's estimate of just over 4,100 equipment models. Further discussion of these changes can be found in Chapter 6 of the RIA.

a. Equipment Fixed Costs

As we noted in the proposal, the most significant changes anticipated for equipment redesign are changes to accommodate the physical changes to engines, especially for those engines that add PM traps and NO_X adsorbers. The costs for engine development and the emission control devices are included as costs to the engines, as described above. Equipment manufacturers must still incur the effort and expense of integrating the engine and emissions control devices into the piece of equipment. Therefore, we have allocated extensive engineering time for this effort.

The costs we have estimated are based on engine power and whether an application is non-motive (e.g., a generator set) or motive (e.g., a skid steer loader). The designs we have considered

[236] "Meeting between Staff of Eagle Crusher Company, Inc., and EPA," memorandum from Todd Sherwood to Air Docket A-2001-28, Docket Item IV-E-40, EDOCKET OAR-2003-0012-0868, March 16, 2004.

to be non-motive are those that lack a propulsion system. In addition, the new emission standards for engines rated under 25 horsepower and the 2008 standards for 25–75 horsepower engines are projected to require no significant equipment redesign beyond that done to accommodate the Tier 2 standards. As explained earlier, we expect that these engines will comply with the new Tier 4 standards through either engine modifications to reduce engine-out emissions or through the addition of a DOC. We have projected that engine modifications will not affect the outer dimensions of the engine and that a DOC will replace the existing muffler. Therefore, either approach taken by the engine manufacturer should have limited to no impact on the equipment design. Nonetheless, we have conservatively estimated their redesign costs at $53,100 per model.[237]

A number of equipment manufacturers have shared detailed information with us regarding the investments made for Nonroad Tier 2 equipment redesign efforts, as well as redesign estimates for significant changes such as installing a new engine design. These estimates range from approximately $53,100 for some lower powered equipment models to well over $1 million dollars for high horsepower equipment with very challenging design constraints. We believe that the equipment redesign efforts undertaken for the T2/3 are representative of the effort that will be required for Tier 4 because the changes needed are the same in nature—increasing available space within the machine to accommodate new hardware. We have based our Tier 4 estimates, in part, on that industry input and have estimated that equipment redesign costs will range from $53,100 per model for 25 horsepower equipment up to $796,500 per model for 300 horsepower equipment and above. For mobile machines greater than750 horsepower, we have used a new redesign cost of $106,000 associated with the 2011 standards which is consistent in scale with the estimate used for 25 to 50 horsepower equipment that add both EGR and a CDPF in the 2013 timeframe. This estimate was not in the proposal. For this larger equipment, we have continued with an estimate of $796,500 associated with the 2015 standards even though we project no need to accommodate a NO_X adsorber. We have attributed only a portion of the equipment redesign costs to U.S. sales in a manner consistent with that taken for engine R&D costs and engine tooling costs. In addition, we expect manufacturers to incur some fixed costs to update service and operation manuals to address the maintenance demands of new emission control technologies and the new oil service intervals; we estimate these service manual updates to cost between $2,660 and $10,620 per equipment model.

These equipment fixed costs (redesign and manual updates) were then allocated appropriately to each new model to arrive at a total equipment fixed cost of $828 million. We have assumed that these costs will be recovered over a ten year period with a seven percent opportunity cost of capital. By comparison, our proposal estimated equipment fixed costs at $698 million. The costs are higher now because of the changes mentioned above – expressing costs in 2002 dollars; attributing all under 25 horsepower redesign costs to U.S. sales; and, correcting upward the number of equipment models to be redesigned.

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[237] Note that the equipment redesign estimates, and all other equipment related costs, have been adjusted from the NPRM to express them in 2002 dollars.

b. Equipment Variable Costs

Equipment variable cost estimates are based on costs for additional materials to mount the new hardware (i.e., brackets and bolts required to secure the aftertreatment devices) and additional sheet metal assuming that the body cladding of a piece of equipment (i.e., the hood) might change to accommodate the aftertreatment system. Variable costs also include the labor required to install these new pieces of hardware. For engines above 75 horsepower – those expected to incorporate CDPF and NO_X adsorber technology – the amount of sheet metal is based on the size of the aftertreatment devices.

For equipment of 150 horsepower and 500 horsepower, respectively, we have estimated the costs to be roughly $60 to $150. Note that we have estimated costs for equipment in all horsepower ranges, and these estimates are presented in detail in the RIA. Throughout this discussion of engine and equipment costs, we present costs for a 150 and a 500 horsepower engine for illustrative purposes.

3. Overall Engine and Equipment Cost Impacts

To illustrate the engine and equipment cost impacts we are estimating for the Tier 4 standards, we have chosen several example pieces of equipment and have presented the estimated costs for them. Using these examples, we can calculate the costs for a specific piece of equipment in several horsepower ranges and better illustrate the cost impacts of the new standards. These costs along with information about each example piece of equipment are shown in table VI.C-1. Costs presented are near-term and long-term costs for the final standards to which each piece of equipment will comply. Long-term costs are only variable costs and, therefore, represent costs after all fixed costs have been recovered and all projected learning has taken place. Included in the table are estimated prices for each piece of equipment to provide some perspective on how our estimated control costs relate to existing equipment prices.

Table VI.C-1. – Near-Term and Long-Term Costs for Several Example Pieces of Equipment[a] ($2002, for the final emission standards to which the equipment must comply)

	Gen-Set	Skid/Steer Loader	Backhoe	Dozer	Ag Tractor	Dozer	Off-Highway Truck
Horsepower	9 hp	33 hp	76 hp	175 hp	250 hp	503 hp	1000 hp
Incremental Engine & Equipment Cost							
Long-Term	$120	$790	$1,200	$2,560	$1,970	$4,140	$4,670
Near-Term	$180	$1,160	$1,700	$3,770	$3,020	$6,320	$8,610
Estimated Equipment Price when New[b]	$4,000	$20,000	$49,000	$238,000	$135,000	$618,000	$840,000
Incremental Operating Costs[c]	-$80	$70	$610	$2,480	$2,110	$7,630	$20,670
Baseline Operating Costs (Fuel & Oil only)[c]	$940	$2,680	$7,960	$27,080	$23,750	$77,850	$179,530

Notes: [a] Near-term costs include both variable costs and fixed costs; long-term costs include only variable costs and represent those costs that remain following recovery of all fixed costs. [b] "Price Database for New Nonroad Equipment," memorandum from Zuimdie Guerra to EDOCKET OAR-2003-0012-0960. [c] Present value of lifetime costs.

More detail and discussion regarding what these costs and prices mean from an economic impact perspective can be found in section VI.E.

D. Annual Costs and Cost Per Ton

One tool that can be used to assess the value of the Tier 4 standards for NRLM fuel and nonroad engines is the costs incurred per ton of emissions reduced. This analysis involves a comparison of our new program to other measures that have been or could be implemented. As summarized in this section and detailed in the RIA, the program being finalized today represents a highly cost effective mobile source control program for reducing PM, NO_X, and SO_2 emissions.

We have calculated the cost per ton of our Tier 4 program based on the net present value of all costs incurred and all emission reductions generated over a 30 year time window following implementation of the program (i.e., calendar years 2007 through 2036). This approach captures

all of the costs and emissions reductions from our new program including those costs incurred and emissions reductions generated by the existing fleet. The baseline for this evaluation is the existing set of fuel and engine standards (i.e., unregulated NRLM fuel and the Tier 2/Tier 3 program). The 30 year time window chosen is meant to capture both the early period of the program when very few new engines that meet the new standards will be in the fleet, and the later period when essentially all engines will meet the new standards.

We have analyzed the cost per ton reduced of several different scenarios. The costs and emissions reductions of each of these scenarios are presented in detail in chapter 8 of the RIA. Here, we present information of the cost and cost effectiveness for the following two scenarios: (1) the full NRLM fuel and nonroad engine program, meaning two steps of fuel control (to 500 ppm and then to 15 ppm) for both NR and L&M fuel and all of the nonroad engine standards; and, (2) the NRLM fuel-only program, meaning two steps of fuel control (to 500 ppm and then to 15 ppm) for both NR and L&M fuel but without any new nonroad engine standards.[238] For the first of these scenarios, the discussion illustrates the costs and relative cost effectiveness of the final NRT4 program to other programs. For the second of these scenarios, the discussion illustrates the costs and cost effectiveness associated with the fuel program as if implemented as a stand alone program without new engine standards.

In sections VI.D.1 and 2, we present the cost of the full NRLM fuel and nonroad engine program and the cost per ton of PM, NO_X+NMHC, and SO_2 reductions that will be realized. The analysis presented in sections VI.D.1 and 2 represents the total Tier 4 program for nonroad diesel engines and NRLM fuel being finalized today. In sections VI.D.3 and 4, we summarize the cost for the NRLM fuel-only scenario and the cost per ton of PM and SO_2 reductions that would be realized.

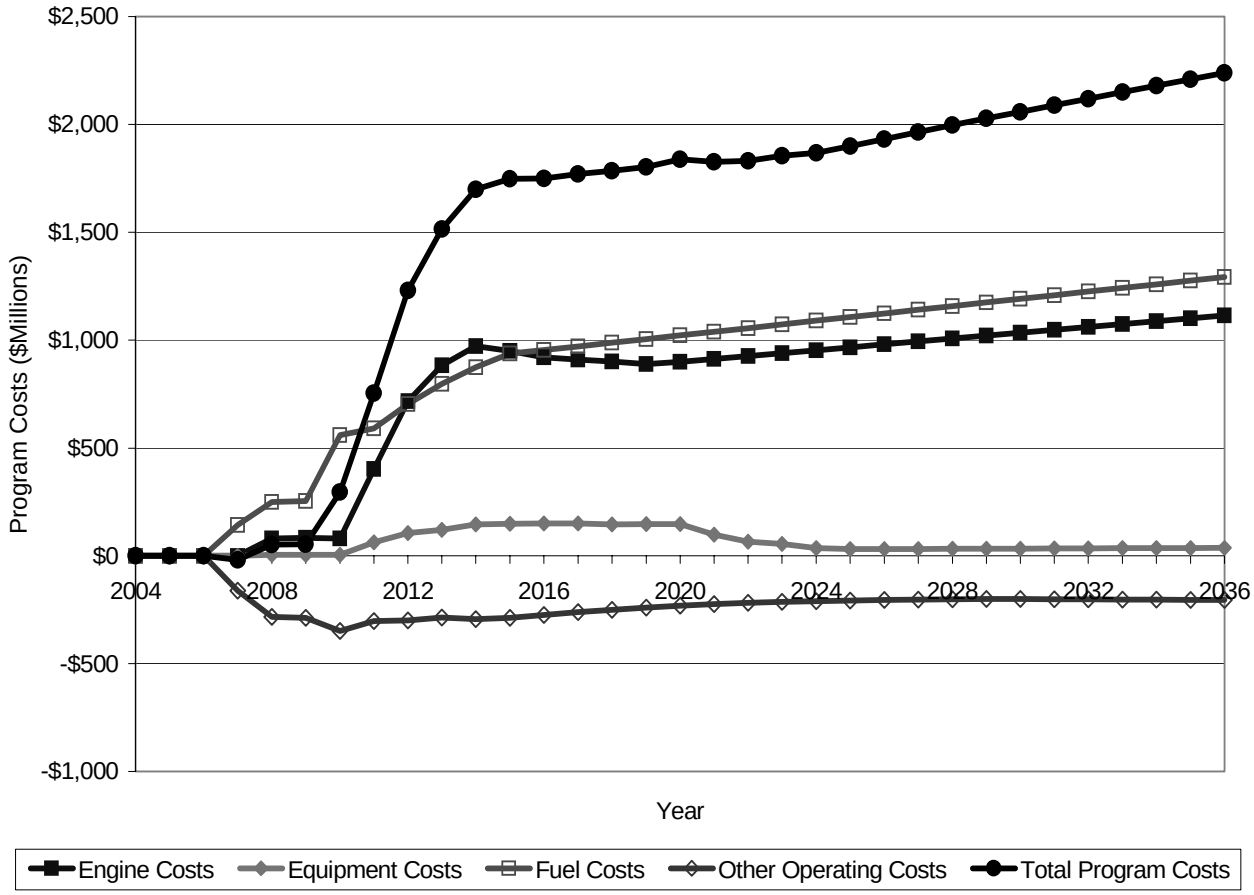
1. Annual Costs for the Full NRLM Fuel and Nonroad Engine Program

The costs of the full NRLM fuel and nonroad engine program include costs associated with both steps in the NRLM fuel program – the NR fuel reduction to 500 ppm sulfur in 2007 and to 15 ppm sulfur in 2010 and the L&M fuel reduction to 500 ppm sulfur in 2007 and to 15 ppm sulfur in 2012. Also included are costs for the 2008 nonroad engine standards for engines less than 75 horsepower, the 2013 standards for 25 to 75 horsepower engines, and costs for the nonroad engine standards for engines above 75 horsepower. All maintenance and operating costs are included along with maintenance savings realized by both the existing fleet (nonroad, locomotive, and marine) and the new fleet of engines complying with the Tier 4 standards.

[238] We are not analyzing a scenario involving just the engine standards because the nonroad engine standards involving advanced emissions control technologies require the use of the 15ppm fuel.

Figure VI.D-1 presents these results. All capital costs for NRLM fuel production and nonroad engine and equipment fixed costs have been amortized at seven percent. The figure shows that total annual costs are estimated to be $50 million in the first year the new engine standards apply, increasing to a peak of $2.2 billion in 2036 as increasing numbers of engines become subject to the new nonroad standards and an ever increasing amount of NRLM fuel is consumed. The net present value of the annualized costs over the period from 2007 to 2036 is $27 billion using a 3 percent discount rate and $14 billion using a 7 percent discount rate.

Figure VI.D-1. – Annual Costs of the Full NRT4 Fuel and Engine Program



2. Cost per Ton of Emissions Reduced for the Full NRLM Fuel and Nonroad Engine Program

We have calculated the cost per ton of emissions reduced associated with the NRT4 engine and NRLM fuel program. The resultant cost per ton numbers depend on how the costs presented above are allocated to each pollutant. Therefore, we have carefully allocated costs according to

the pollutants for which they are incurred. Where fuel changes occur in conjunction with new engine standards (engine standards enabled by those fuel changes), we allocate one-half of the fuel-related costs to fuel-derived emissions reductions (PM and SO_2, with one-third of that half allocated to PM and two-thirds to SO_2) and one-half to engine-derived emissions reductions (NO_X+NMHC and PM, with that half split 50/50 between each pollutant). Where fuel changes occur without new engine standards on which fuel changes are premised (i.e., 500ppm NRLM fuel and 15ppm L&M fuel), we have allocated costs associated with fuel-derived emissions reductions one-third to PM and two-thirds to SO_2. We have allocated costs associated with engine-derived emissions reductions (i.e., engine/equipment costs) directly to the pollutant for which the cost is incurred. These engine and equipment cost allocations are noted throughout the discussion in section VI.C, and are detailed in full in chapter 8 of the RIA.

We have calculated the costs per ton using the net present value of the annualized costs of the program through 2036 and the net present value of the annual emission reductions through 2036. We have also calculated the cost per ton of emissions reduced in the year 2030 using the annual costs and emissions reductions in that year alone. This number represents the long-term cost per ton of emissions reduced. The cost per ton numbers include costs and emission reductions that will occur from the existing fleet (i.e., those pieces of nonroad equipment that were sold into the market prior to the new emission standards). These results are shown in Table VI.D-1 using both a three percent and a seven percent social discount rate.

Table VI.D-1. – Total Fuel and Engine Program
30 Year Aggregate Cost per Ton and Long-Term Annual Cost Per Ton
($2002)

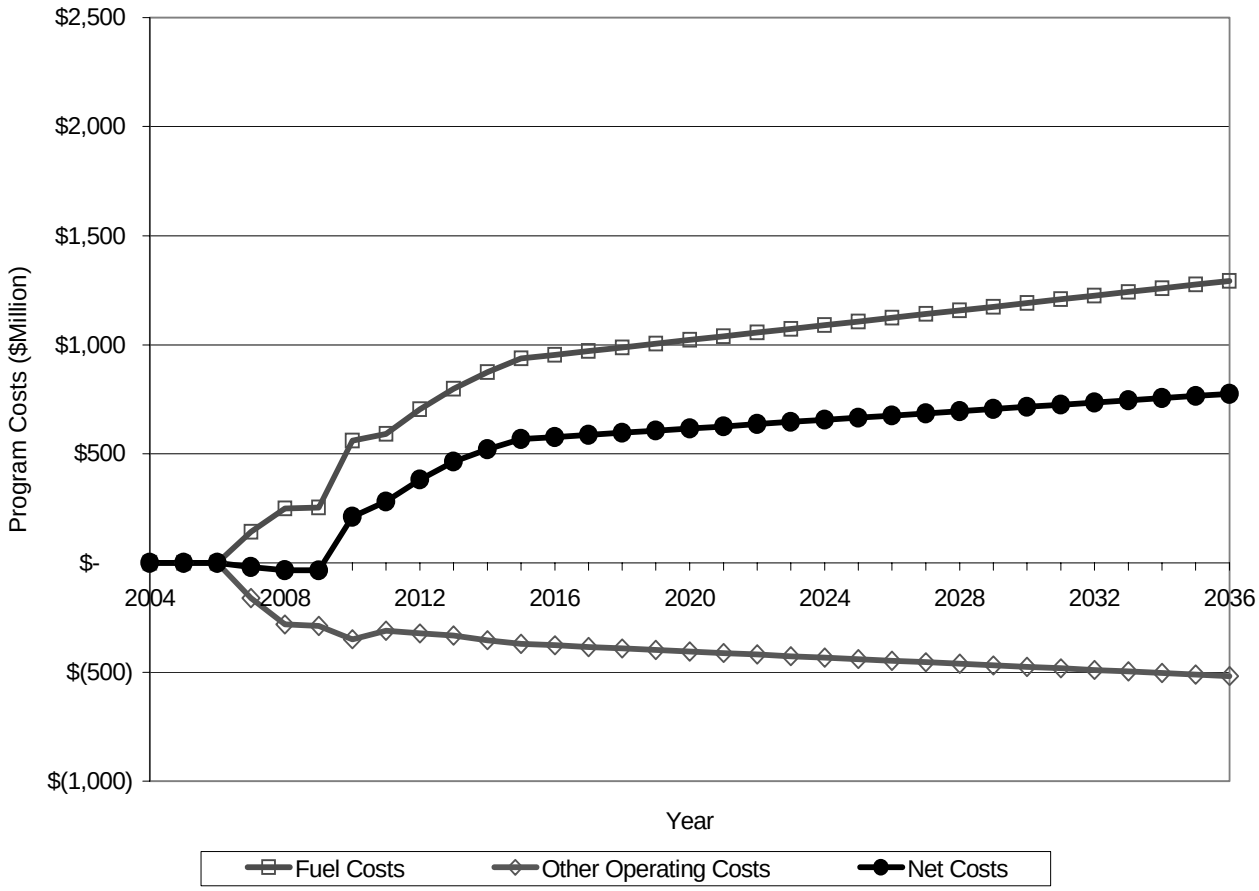
Pollutant	30 Year Discounted Lifetime Cost per ton at 3%	30 Year Discounted Lifetime Cost per ton at 7%	Long-Term Cost per Ton in 2030
NO_X+NMHC	$1,010	$1,160	$680
PM	$11,200	$11,800	$9,300
SO_X	$690	$620	$810

3. Annual Costs for the NRLM Fuel-only Scenario

Cent per gallon costs for the new 500 ppm NRLM fuel, the new 500 ppm L&M fuel, the new 15 ppm NR fuel, and the new 15 ppm NRLM fuel were presented in section IV.A. Having this fuel will result in maintenance savings associated with increased oil change intervals for both the new and the existing fleet of nonroad, locomotive, and marine engines. These maintenance savings were discussed in section VI.B. There are no engine and equipment costs associated with the NRLM fuel-only scenario because new engine emissions standards are not included in that scenario. Figure VI.D-2 shows the annual costs associated with the NRLM fuel-only program.

As can be seen in figure VI.D-1, the costs for refining and distributing the fuel range from $250 million in 2008 to nearly $1.3 billion in 2036. The increase in fuel costs in 2010 reflect the change to higher cost 15 ppm NR fuel. Fuel costs continue to grow as more fuel is consumed by the increasing number of engines and equipment. The fuel costs are largely offset by the maintenance savings that range from $250 million in 2008 to $500 million in 2036. As a whole, the net cost of the program in each year ranges from a small net savings in 2008 to around $780 million in 2036. The net present value (i.e., the value in 2004) of the net costs associated with the NRLM fuel-only program during the 30 year period from 2007 to 2036 is estimated at $9.2 billion using a 3 percent discount rate and $4.6 billion using a 7 percent discount rate.

Figure VI.D-2. – Annual Costs of the NRLM Fuel-only Scenario



4. Cost Per Ton of Emissions Reduced for the NRLM Fuel-only Scenario

The fuel-borne sulfur reduction under the NRLM fuel-only scenario will result in significant reductions of both SO_2 and PM emissions. Since there are no new engine standards

associated with the NRLM fuel-only scenario, the emissions reductions that result are entirely fuel-derived. Roughly 98 percent of fuel-borne sulfur is converted to SO_2 in the engine with the remaining two percent being exhausted as sulfate PM. We have allocated one-third of the costs of this program to PM control and two-thirds to SO_2 control. This is consistent with the cost accounting we have used throughout our analysis in that costs associated with fuel-derived emissions reductions are attributed one-third to PM control and two-thirds to SO_2 control.

As discussed above, the 30 year net present value of costs associated with the fuel-only program are estimated at $9.2 billion using 3 percent discounting and $4.6 billion using 7 percent discounting. We have estimated the 30 year net present value of the SO_2 emission reductions at 5.7 million tons and PM emission reductions at 462,000 tons using 3 percent discounting, 3.2 million tons and 255,000 tons, respectively, using 7 percent discounting.

Table VI.D-1 shows the cost per ton of emissions reduced as a result of the NRLM fuel-only scenario. The cost per ton numbers include costs and emissions reductions that will occur from both the new and the existing fleet (i.e., those pieces of nonroad equipment that were sold into the market prior to the new fuel standards) of nonroad, locomotive, and marine engines.

Table VI.D-2. – NRLM Fuel-only Scenario
30 year Aggregate Cost per Ton and Long-Term Annual Cost Per Ton
($2002)

Pollutant	30 Year Discounted Lifetime Cost per ton at 3%	30 Year Discounted Lifetime Cost per ton at 7%	Long-Term Cost per Ton in 2030
PM	$6,600	$6,000	$7,900
SO_2	$1,070	$970	$1,270

We also considered the cost per ton of the NRLM fuel-only scenario without including the expected maintenance savings associated with low sulfur fuel. Without the maintenance savings, the 30 year discounted cost per ton of PM reduced would be $11,800 and of SO_2 reduced would be $1,900 using 3 percent discounting and $11,200 and $1,800, respectively, using 7 percent discounting. More detail on how the costs and cost per ton numbers associated with the NRLM fuel-only scenario were calculated can be found in the RIA.

5. Comparison With Other Means of Reducing Emissions

In comparison with other emissions control programs, we believe that the Tier 4 programs represent a cost effective strategy for generating substantial NO_X+NMHC, PM, and SO_2 reductions. This can be seen by comparing the cost per ton of emissions reduced by the NRLM fuel-only scenario (i.e., reducing fuel sulfur to 500 ppm in 2007 and 15 ppm in 2010 without any new nonroad engine standards) and the cost per ton of emissions reduced by the full NRLM fuel

and nonroad engine program (i.e., fuel control and new engine standards) with a number of standards that EPA has adopted in the past. Tables VI.D-3 and VI.D-4 summarize the cost per ton of several past EPA actions to reduce emissions of NO_X+NMHC and PM from mobile sources, all of which were considered by EPA to be appropriate.

Table VI.D-3. – NRT4 Cost Per Ton comparison to Previous Mobile Source Programs for NO_X + NMHC

Program	*$/ton*
Tier 4 Nonroad Diesel (full program)	1,010
Tier 2 Nonroad Diesel	630
Tier 3 Nonroad Diesel	430
Tier 2 vehicle/gasoline sulfur	1,400 - 2,350
2007 Highway HD	2,240
2004 Highway HD	220 - 430
Tier 1 vehicle	2,150 - 2,910
NLEV	2,020
Marine SI engines	1,220 - 1,930
On-board diagnostics	2,410
Marine CI engines	30 - 190
Large SI Exhaust	80
Recreational Marine	670

Note: Costs adjusted to 2002 dollars using the Producer Price Index for Total Manufacturing Industries.

Table VI.D-4. – NRT4 Cost Per Ton Comparison To Previous Mobile Source Programs for PM

Program	*$/ton*
Tier 4 Nonroad Diesel (full program)	11,200
Tier 4 NRLM fuel-only (fuel-only scenario)	6,800
Tier 1/Tier 2 Nonroad Diesel	2,390
2007 Highway HD	14,180
Marine CI engines	4,040 -5,440
1996 urban bus	12,780 - 20,450
Urban bus retrofit/rebuild	31,530
1994 highway HD diesel	21,780 - 25,500

Note: Costs adjusted to 2002 dollars using the Producer Price Index for Total Manufacturing Industries.

To compare the cost per ton of SO_2 emissions reduced, we looked at the cost per ton for the Title IV (acid rain) SO_2 trading programs. This information is found in EPA report 430/R-02-004, "Documentation of EPA Modeling Applications (V.2.1) Using the Integrated Planning Model", in Figure 9.11 on page 9-14 (www.epa.gov/airmarkets/epa-ipm/index.html#documentation). The SO_2 cost per ton results of the full Tier 4 program presented in table VI.D-2 compare very favorably with the program shown in table VI.D-5.

Table VI.D-5. – NRT4 Cost Per Ton Comparison to SO_2 from both the EPA Base Case 2000 for the Title IV SO_2 Trading Programs and the Proposed Interstate Air Quality Rule

Program	*$/ton*
Tier 4 Nonroad Diesel (full program)	$690
Tier 4 Nonroad Diesel (fuel-only scenario)	$1,070
Title IV SO_2 Trading Programs	$490 in 2010 to $610 in 2020
Interstate Air Quality Rule (average cost)	$730 in 2010 to $830 in 2015

Note: Costs adjusted to 2002 dollars using the Producer Price Index for Total Manufacturing Industries.

As the above comparisons show, both the NRLM fuel-only scenario, when viewed by itself, and the combination of NRLM fuel and nonroad engine standards, are both cost effective strategies to achieve the associated emissions reductions.

E. Do the Benefits Outweigh the Costs of the Standards?

Our analysis of the health and environmental benefits to be expected from this final rule are presented in this section. Briefly, the analysis projects major benefits throughout the period from initial implementation of the rule over a 30 year period through 2036. As described below, thousands of deaths and other serious health effects would be prevented, yielding a net present value in 2004 of those benefits we could monetize of approximately $805 billion dollars using a 3 percent discount rate and $352 billion using a 7 percent discount rate. These benefits exceed the net present value of the social cost of the proposal ($27 billion using a 3 percent discount rate and $14 billion using a 7 percent discount rate) by $780 billion using a 3 percent discount rate and $340 billion using a 7 percent discount rate.

1. What Were the Results of the Benefit-Cost Analysis?

Table VI.E-1 presents the primary estimate of reduced incidence of PM-related health effects for the years 2020 and 2030. In interpreting the results, it is important to keep in mind the limited set of effects we are able to monetize. Specifically, the table lists the PM-related benefits associated with the reduction of several health effects. In 2030, we estimate that there will be 12,000 fewer fatalities in adults[239] and 20 fewer fatalities in infants per year associated with fine PM, and the rule will result in about 5,600 fewer cases of chronic bronchitis, 8,900 fewer hospitalizations (for respiratory and cardiovascular disease combined), and result in 1 million days per year when adults miss work because of their respiratory symptoms and 5.9 million days of when adults must restrict their activity due to respiratory illness. We also estimate substantial health improvements for children from reduced upper and lower respiratory illness, acute

[239] While we did not include separate estimates of the number of premature deaths that would be avoided due to reductions in ozone levels, recent evidence has been found linking short-term ozone exposures with premature mortality independent of PM exposures. Recent reports by Thurston and Ito (2001) and the World Health Organization (WHO) support an independent ozone mortality impact, and the EPA Science Advisory Board has recommended that EPA reevaluate the ozone mortality literature for possible inclusion in the estimate of total benefits. Based on these new analyses and recommendations, EPA is sponsoring three independent meta-analyses of the ozone-mortality epidemiology literature to inform a determination on inclusion of this important health endpoint. Upon completion and peer-review of the meta-analyses, EPA will make its determination on whether and how benefits of reductions in ozone-related mortality will be included in the benefits analysis for future rulemakings.

bronchitis, and asthma attacks.[240] We were unable to quantify the benefits related to ozone and other pollutants for the final rule, although we do present some preliminary ozone modeling in Chapter 9 of the RIA.

Table VI.E-2 presents the total monetized benefits for the years 2020 and 2030. This table also indicates with a "B" those additional health and environmental effects which we were unable to quantify or monetize. These effects are additive to estimate of total benefits, and EPA believes there is considerable value to the public of the benefits that could not be monetized. A full listing of the benefit categories that could not be quantified or monetized in our estimate are provided in table VI.E-6.

In summary, EPA's primary estimate of the benefits of the rule are $83 + B billion in 2030 using a 3 percent discount rate and $78 + B billion using a 7 percent discount rate. In 2020, total monetized benefits are $42 + B billion using a 3 percent discount rate and $41 + B billion using a 7 percent discount rate. These estimates account for growth in real gross domestic product (GDP) per capita between the present and the years 2020 and 2030. As the table indicates, total benefits are driven primarily by the reduction in premature fatalities each year, which account for over 90 percent of total benefits.

[240] Our PM-related estimate in 2030 incorporates significant reductions of 160,000 fewer cases of lower respiratory symptoms in children ages 7 to 14 each year, 120,000 fewer cases of upper respiratory symptoms (similar to cold symptoms) in asthmatic children each year, and 13,000 fewer cases of acute bronchitis in children ages 8 to 12 each year. In addition, we estimate that this rule will reduce almost 6,000 emergency room visits for asthma attacks in children each year from reduced exposure to particles. Additional incidents would be avoided from reduced ozone exposures. Asthma is the most prevalent chronic disease among children and currently affects over seven percent of children under 18 years of age.

Table VI.E-1. – Reductions in Incidence of PM-related Adverse Health Effects Associated with the Final Nonroad Diesel Engine and Fuel Standards Full Program

Endpoint	Avoided Incidence[a] (cases/year)	
	2020	2030
Premature mortality[b]: Long-term exposure (adults, 30 and over)	6,500	12,000
Infant mortality (infants under one year)	15	22
Chronic bronchitis (adults, 26 and over)	3,500	5,600
Non-fatal myocardial infarctions (adults, 18 and older)	8,700	15,000
Hospital admissions – Respiratory (adults, 20 and older)[c]	2,800	5,100
Hospital admissions – Cardiovascular (adults, 20 and older)[d]	2,300	3,800
Emergency Room Visits for Asthma (18 and younger)	3,800	6,000
Acute bronchitis (children, 8-12)	8,400	13,000
Asthma exacerbations (asthmatic children, 6-18)	120,000	200,000
Lower respiratory symptoms (children, 7-14)	100,000	160,000
Upper respiratory symptoms (asthmatic children, 9-11)	76,000	120,000
Work loss days (adults, 18-65)	670,000	1,000,000
Minor restricted activity days (adults, age 18-65)	4,000,000	5,900,000

Notes: [a] Incidences are rounded to two significant digits. [b] Premature mortality associated with ozone is not separately included in this analysis. [c] Respiratory hospital admissions for PM includes admissions for COPD, pneumonia, and asthma. [d] Cardiovascular hospital admissions for PM includes total cardiovascular and subcategories for ischemic heart disease, dysrhythmias, and heart failure.

Table VI.E-2. – EPA Primary Estimate of the Annual Quantified and Monetized Benefits Associated with Improved PM Air Quality Resulting from the Final Nonroad Diesel Engine and Fuel Standards Full Program

Endpoint	Monetary Benefits[a,b] (millions 2000$, Adjusted for Income Growth)	
	2020	2030
Premature mortality[c]: (adults, 30 and over)		
3% discount rate	$41,000	$77,000
7% discount rate	$38,000	$72,000
Infant mortality (infants under one year)	$97	$150
Chronic bronchitis (adults, 26 and over)	$1,500	$2,400
Non-fatal myocardial infarctions[d]		
3% discount rate	$750	$1,200
7% discount rate	$720	$1,200
Hospital Admissions from Respiratory Causes[e]	$49	$92
Hospital Admissions from Cardiovascular Causes[f]	$51	$83
Emergency Room Visits for Asthma	$1.1	$1.7
Acute bronchitis (children, 8-12)	$3.2	$5.2
Asthma exacerbations (asthmatic children, 6-18)	$5.7	$9.2
Lower respiratory symptoms (children, 7-14)	$1.7	$2.7
Upper respiratory symptoms (asthmatic children, 9-11)	$2.0	$3.2
Work loss days (adults, 18-65)	$92	$130
Minor restricted activity days (adults, age 18-65)	$210	$320
Recreational visibility (86 Class I Areas)	$1,000	$1,700
Monetized Total[g]		
3% discount rate	$44,000+B	$83,000+B
7% discount rate	$42,000+B	$78,000+B

Notes: [a] Monetary benefits are rounded to two significant digits. [b] Monetary benefits are adjusted to account for growth in real GDP per capita between 1990 and the analysis year (2020 or 2030). [c] Valuation of base estimate assumes discounting over the lag structure described in the RIA Chapter 9. [d] Estimates assume costs of illness and lost earnings in later life years are discounted using either 3 or 7 percent. [e] Respiratory hospital admissions for PM includes admissions for COPD, pneumonia, and asthma. [f] Cardiovascular hospital admissions for PM includes total cardiovascular and subcategories for ischemic heart disease, dysrhythmias, and heart failure. [g] B represents the monetary value of the unmonetized health and welfare benefits. A detailed listing of unquantified PM, ozone, CO, and NMHC related health effects is provided in Table VI.E-6.

The estimated social cost (measured as changes in consumer and producer surplus) in 2030 to implement the final rule from table VI.E-3 is $2.0 billion (2000$). Thus, the net benefit (social benefits minus social costs) of the program at full implementation is approximately $81 + B billion using a 3 percent discount rate and $78 + B billion using a 7 percent discount rate. In 2020, partial implementation of the program yields net benefits of $42 + B billion using a 3 percent discount rate and $41 + B billion using a 7 percent discount rate. Therefore, implementation of the final rule is expected to provide society with a net gain in social welfare based on economic efficiency criteria. Table VI.E-3 presents a summary of the benefits, costs, and net benefits of the final rule's full program. Figure VI-E.1 displays the stream of benefits, costs, and net benefits of the Nonroad Diesel Vehicle Rule from 2007 to 2036 using two different discount rates. In addition, table VI.E-4 presents the net present value of the stream of benefits, costs, and net benefits associated with the rule for this 30 year period. The total net present value in 2004 of the stream of net benefits (benefits minus costs) is $780 billion using a 3 percent discount rate and $340 billion using a 7 percent discount rate.

Table VI.E-3. – Summary of Benefits, Costs, and Net Benefits of the Final Nonroad Diesel Engine and Fuel Standards Full Program

	2020[a] (Billions of 2000 dollars)	2030[a] (Billions of 2000 dollars)
Social Costs[b]	$1.8	$2.0
Social Benefits:[b, c, d]		
CO, VOC, Air Toxic-related benefits	Not monetized	Not monetized
Ozone-related benefits	Not monetized	Not monetized
PM-related Welfare benefits	$1.0	$1.7
PM-related Health benefits [3% discount]	$43 + B	$81 + B
PM-related Health benefits [7% discount]	$41 + B	$78 + B
Net Benefits (Benefits-Costs) [3% discount][c]	$44 + B	$81 + B
Net Benefits (Benefits-Costs) [7% discount][c]	$42 + B	$78 + B

Notes: [a] All costs and benefits are calculated using 3 and 7 percent discount rates and are rounded to two significant digits. Numbers may appear not to sum due to rounding. [b] Note that costs are the total costs of reducing all pollutants, including CO, VOCs and air toxics, as well as NO_X and PM. Costs were converted to 2000$ using the PPI for Total Manufacturing Industries. Benefits in this table are associated only with PM endpoints related to direct PM, NO_X and SO_2 reductions in 48-states. [c] 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.E-6. B is the sum of all unquantified benefits and disbenefits.

Figure VI.E-1. – Stream of Benefits, Costs, and Net Benefits of the Final Nonroad Diesel Engine and Fuel Standards Full Program

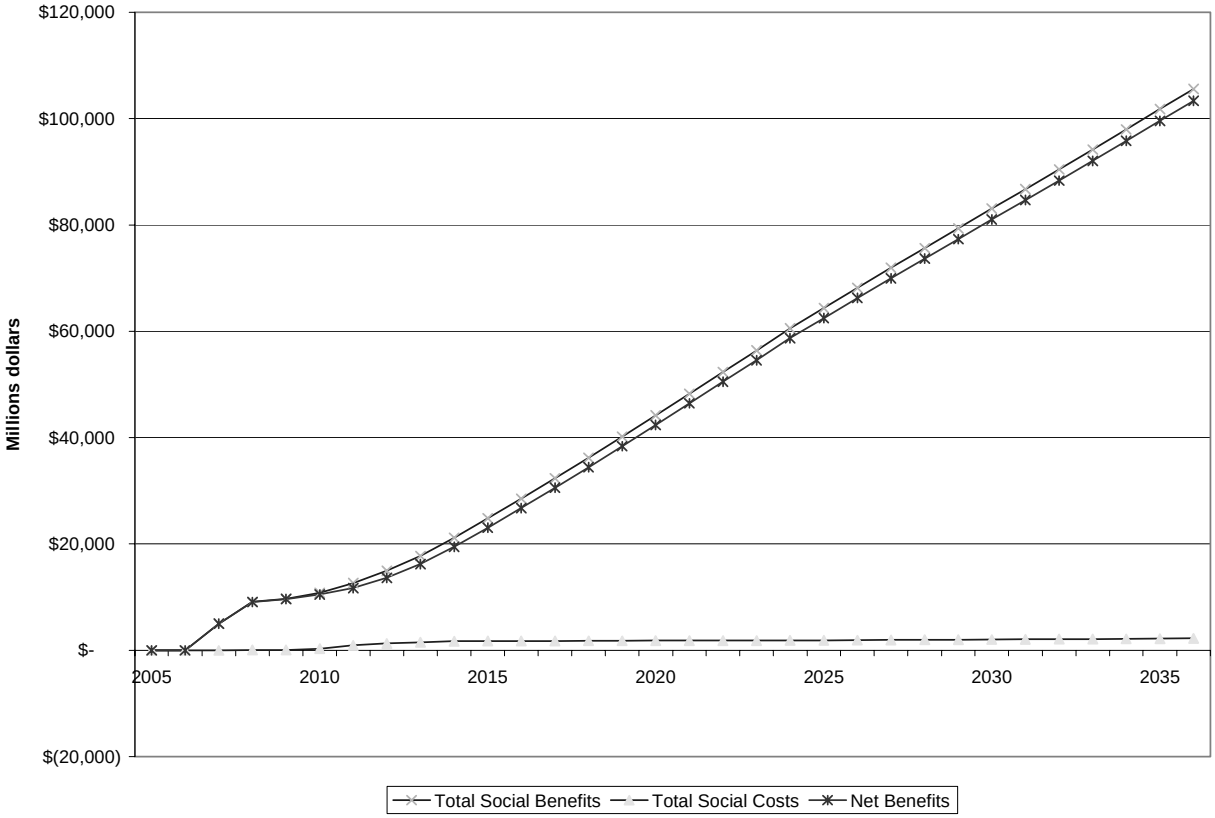


Table VI.E-4. – Net Present Value in 2004 of the Stream of 30 years of Benefits, Costs, and Net Benefits for the Full Nonroad Diesel Engine and Fuel Standards (Billions of 2000$)

	Billions of 2000$ 3% Discount Rate	**Billions of 2000$** 7% Discount Rate
Social Costs	$ 27	$ 14
Social Benefits	$805	$352
Net Benefits [a]	$780	$340

Notes: [a] Numbers do not add due to rounding. Benefits represent 48-state benefits and exclude home heating oil sulfur reduction benefits, whereas costs include 50-state estimates.

In addition, we analyzed the social benefits and costs of the fuel-only components of the program, as discussed in the RIA. EPA's primary estimate of the benefits of the fuel-only component of the final rule are approximately $28 + B billion in 2030 using a 3 percent discount rate and $25 + B billion using a 7 percent discount rate. In 2020, total monetized benefits are approximately $18 + B billion using a 3 percent discount rate and $16 + B billion using a 7 percent discount rate. These estimates account for growth in real gross domestic product (GDP) per capita between the present and the years 2020 and 2030. We present the engineering costs of implementing the fuel-only components of the rule. Engineering compliance costs are very similar to the total social costs for the entire program. The net benefit (social benefits minus engineering costs) of the fuel-only program at full implementation is approximately $330 + B billion using a 3 percent discount rate and $160 + B billion using a 7 percent discount rate. Therefore, implementation of the fuel-only components of the final rule is expected to provide society with a net gain in social welfare based on economic efficiency criteria. Table VI.E-5 presents a summary of the social benefits, engineering costs, and net benefits of the final rule's fuel-only program for a 30 year period.

Table VI.E-5. – Net Present Value in 2004 of the Stream of Benefits, Costs, and Net Benefits for the Fuel-Only Standards (Billions of 2000$)

	3% Discount Rate	7% Discount rate
Costs	$9.2	$4.6
Social Benefits	$340	$160
Net Benefits	$330	$160

Notes:
[A] Results are rounded to two significant digits. Sums may differ because of rounding.
[B] Engineering costs are presented instead of social costs. As discussed in previous chapters, total engineering costs include fuel costs (refining, distribution, lubricity) and other operating costs (oil change maintenance savings).
[C] Note that costs are the total costs of reducing all pollutants, including CO, VOCs and air toxics, as well as NO_X and PM. Benefits in this table are associated only with PM, NO_X and SO_2 reductions. The estimates do not include the benefits of reduced sulfur in home heating oil or benefits in Alaska or Hawaii.

2. What Was Our Overall Approach to the Benefit-Cost Analysis?

The basic question we sought to answer in the benefit-cost analysis was, "What are the net yearly economic benefits to society of the reduction in mobile source emissions likely to be achieved by this proposed rulemaking?" In designing an analysis to address this question, we selected two future years for analysis (2020 and 2030) that are representative of the stream of benefits and costs at partial and full-implementation of the program.

To quantify benefits, we evaluated PM-related health effects (including directly emitted PM and sulfate, as well as SO_2 and NO_X contributions to fine particulate matter). Our approach requires the estimation of changes in air quality expected from the rule and then estimating the resulting impact on health. In order to characterize the benefits of today's action, given the constraints on time and resources available for the analysis, we adopted a benefits transfer technique that relies on air quality and benefits modeling for a preliminary control option for nonroad diesel engines and fuels. Results from this modeling conducted for 2020 and 2030 are then scaled and transferred to the emission reductions expected from the final rule. We also transferred modeled results by using scaling factors associated with time to examine the stream of benefits in years other than 2020 and 2030.

More specifically, our health benefits assessment is conducted in two phases. Due to the time requirements for running the sophisticated emissions and air quality models, it is often

necessary to select an example set of emission reductions to use for the purposes of emissions and air quality modeling early in the development of the proposal. In phase one, we evaluate the PM- and ozone-related health effects associated with a modeled preliminary control option that was a close approximation of the standards in the years 2020 and 2030. Using information from the modeled preliminary control option on the changes in ambient concentrations of PM and ozone, we then estimate the number of reduced incidences of illnesses, hospitalizations, and premature fatalities associated with this scenario and estimate the total economic value of these health benefits. Based on public comment and other data described in the RIA, the standards we are finalizing in this rulemaking are slightly different in the amount of emission reductions expected to be achieved in 2020 and 2030 relative to the modeled scenario. Thus, in phase two of the analysis, we apportion the results of the phase one analysis to the underlying NO_X, SO_2, and PM emission reductions and scale the apportioned benefits to reflect differences in emissions reductions between the modeled preliminary control option and the proposed standards. The sum of the scaled benefits for the PM, SO_2, and NO_X emission reductions provide us with the total benefits of the rule.

The benefit estimates derived from the modeled preliminary control option in phase one of our analysis uses an analytical structure and sequence similar to that used in the benefits analyses for the Heavy Duty Engine/Diesel Fuel final rule and in the "section 812 studies" to estimate the total benefits and costs of the full Clean Air Act.[241] We used many of the same models and assumptions used in the Heavy Duty Engine/Diesel Fuel analysis as well as other Regulatory Impact Analyses (RIAs) prepared by the Office of Air and Radiation. By adopting the major design elements, models, and assumptions developed for the section 812 studies and other RIAs, we have largely relied on methods which have already received extensive review by the independent Science Advisory Board (SAB), by the public, and by other federal agencies. In addition, we will be working through the next section 812 study process to enhance our methods.[242]

The benefits transfer method used in phase two of the analysis is similar to that used to estimate benefits in the recent analysis of the Nonroad Large Spark-Ignition Engines and Recreational Engines standards (67 FR 68241, November 8, 2002). A similar method has also been used in recent benefits analyses for the proposed Industrial Boilers and Process Heaters NESHAP and the Reciprocating Internal Combustion Engines NESHAP.

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[241] The section 812 studies include: (1) U.S. EPA, Report to Congress: The Benefits and Costs of the Clean Air Act, 1970 to 1990, October 1997 (also known as the ``Section 812 Retrospective Report"); and (2) the first in the ongoing series of prospective studies estimating the total costs and benefits of the Clean Air Act (see EPA report number: EPA-410-R-99-001, November 1999). See Docket A-99-06, Document II-A-21.

[242] Interested parties may want to consult the webpage: http://www.epa.gov/science1 regarding components of our analytical blueprint.

On September 26, 2002, the National Academy of Sciences (NAS) released a report on its review of the Agency's methodology for analyzing the health benefits of measures taken to reduce air pollution. The report focused on EPA's approach for estimating the health benefits of regulations designed to reduce concentrations of airborne PM.

In its report, the NAS panel said that EPA has generally used a reasonable framework for analyzing the health benefits of PM-control measures. It recommended, however, that the Agency take a number of steps to improve its benefits analysis. In particular, the NAS stated that the Agency should:

- Include benefits estimates for a range of regulatory options;
- Estimate benefits for intervals, such as every five years, rather than a single year;
- Clearly state the projected baseline statistics used in estimating health benefits, including those for air emissions, air quality, and health outcomes;
- Examine whether implementation of proposed regulations might cause unintended impacts on human health or the environment;
- When appropriate, use data from non-U.S. studies to broaden age ranges to which current estimates apply and to include more types of relevant health outcomes; and
- Begin to move the assessment of uncertainties from its ancillary analyses into its Base analyses by conducting probabilistic, multiple-source uncertainty analyses. This assessment should be based on available data and expert judgment.

Although the NAS made a number of recommendations for improvement in EPA's approach, it found that the studies selected by EPA for use in its benefits analysis were generally reasonable choices. In particular, the NAS agreed with EPA's decision to use cohort studies to derive benefits estimates. It also concluded that the Agency's selection of the American Cancer Society (ACS) study for the evaluation of PM-related premature mortality was reasonable, although it noted the publication of new cohort studies that should be evaluated by the Agency.

EPA has addressed many of the NAS comments in our analysis of the final rule. We provide benefits estimates for each year over the rule implementation period for a wide range of regulatory alternatives, in addition to our final emission control program. We use the estimated time path of benefits and costs to calculate the net present value of benefits of the rule. In the RIA, we provide baseline statistics for air emissions, air quality, population, and health outcomes. We have examined how our benefits estimates might be impacted by expanding the age ranges to which epidemiological studies are applied, and we have added several new health endpoints, including non-fatal heart attacks, which are supported by both U.S. studies and studies conducted in Europe. We have also improved the documentation of our methods and provided additional details about model assumptions.

Several of the NAS recommendations addressed the issue of uncertainty and how the Agency can better analyze and communicate the uncertainties associated with its benefits assessments. In particular, the Committee expressed concern about the Agency's reliance on a single value from its analysis and suggested that EPA develop a probabilistic approach for analyzing the health benefits of proposed regulatory actions. The Agency agrees with this suggestion and is working to develop such an approach for use in future rulemakings.

EPA plans to continue to refine its plans for addressing uncertainty in its analyses. EPA conducted a pilot study to address uncertainty in important analytical parameters such as the concentration-response relationship for PM-related premature mortality. EPA is also conducting longer-term elements intended to provide scientifically sound, peer-reviewed characterizations of the uncertainty surrounding a broader set of analytical parameters and assumptions, including but not limited to emissions and air quality modeling, demographic projections, population health status, concentration-response functions, and valuation estimates.

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. Deficiencies in 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. While these general uncertainties in the underlying scientific and economics literatures, which can cause the valuations to be higher or lower, are discussed in detail in the Regulatory Support Document and its supporting documents and references, the key uncertainties which have a bearing on the results of the benefit-cost analysis of this final rule include the following:

- The exclusion of potentially significant benefit categories (such as health, odor, and ecological benefits of reduction in CO, VOCs, air toxics, and ozone);
- Errors in measurement and projection for variables such as population growth;
- Uncertainties in the estimation of future year emissions inventories and air quality;
- Uncertainties associated with the scaling of the results of the modeled benefits analysis to the proposed standards, especially regarding the assumption of similarity in geographic distribution between emissions and human populations and years of analysis;
- Variability in the estimated relationships of health and welfare effects to changes in pollutant concentrations;
- Uncertainties in exposure estimation; and

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

Despite these uncertainties, we believe the benefit-cost analysis provides a reasonable indication of the expected economic benefits of the final rulemaking in future years under a set of assumptions. Accordingly, we present a primary estimate of the total benefits, based on our interpretation of the best available scientific literature and methods and supported by the SAB-HES and the NAS.

Some of the key assumptions underlying the primary estimate for the premature mortality which accounts for 90 percent of the total benefits we were able to quantify include the following:

(1) 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 definitively established, the weight of the available epidemiological evidence supports an assumption of causality.

(2) 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 EGUs may differ significantly from direct PM released from diesel engines and other industrial sources, but no clear scientific grounds exist for supporting differential effects estimates by particle type.

(3) The impact function for fine particles is approximately linear within the range of ambient concentrations under consideration. Thus, the estimates include health benefits from reducing fine particles in areas with varied concentrations of PM, including both regions that are in attainment with fine particle standard and those that do not meet the standard.

(4) The forecasts for future emissions and associated air quality modeling are valid. Although recognizing the difficulties, assumptions, and inherent uncertainties in the overall enterprise, these analyses are based on peer-reviewed scientific literature and up-to-date assessment tools, and we believe the results are highly useful in assessing this rule.

We provide sensitivity analyses to illustrate the effects of uncertainty about key analytical assumptions in the RIA.

In addition, one significant limitation to the benefit transfer method applied in this analysis is the inability to scale ozone-related benefits. Because ozone is a homogeneous gaseous pollutant, it is not possible to apportion ozone benefits to the precursor emissions of NO_X and VOC. Coupled with the potential for NO_X reductions to either increase or decrease ambient ozone levels, this prevents us from scaling the benefits associated with a particular combination of VOC and NO_X emissions reductions to another. Because of our inability to scale ozone benefits,

we do not include ozone benefits as part of the monetized benefits of the proposed standards. For the most part, ozone benefits contribute substantially less to the monetized benefits than do benefits from PM, thus their omission will not materially affect the conclusions of the benefits analysis. Although we expect economic benefits to exist, we were unable to quantify or to value specific changes in ozone, CO or air toxics because we did not perform additional air quality modeling.

There are also a number of health and environmental effects which we were unable to quantify or monetize. A full appreciation of the overall economic consequences of the proposed rule requires consideration of all benefits and costs expected to result from the new standards, not just those benefits and costs which could be expressed here in dollar terms. A complete listing of the benefit categories that could not be quantified or monetized in our estimate are provided in Table VI.E-6. These effects are denoted by “B” in Table VI.E-3 above, and are additive to the estimates of benefits.

Table VI.E-6. – Additional, Non-monetized Benefits of the Nonroad Diesel Engine and Fuel Standards

Pollutant	Unquantified Effects
Ozone Health	Premature mortality[a] Respiratory hospital admissions Minor restricted activity days Increased airway responsiveness to stimuli Inflammation in the lung Chronic respiratory damage Premature aging of the lungs Acute inflammation and respiratory cell damage Increased susceptibility to respiratory infection Non-asthma respiratory emergency room visits Increased school absence rates
Ozone Welfare	Decreased yields for commercial forests Decreased yields for fruits and vegetables Decreased yields for non-commercial crops Damage to urban ornamental plants Impacts on recreational demand from damaged forest aesthetics Damage to ecosystem functions
PM Health	Low birth weight Changes in pulmonary function Chronic respiratory diseases other than chronic bronchitis Morphological changes Altered host defense mechanisms Cancer Non-asthma respiratory emergency room visits
PM Welfare	Visibility in many Class I areas Residential and recreational visibility in non-Class I areas Soiling and materials damage Damage to ecosystem functions
Nitrogen and Sulfate Deposition Welfare	Impacts of acidic sulfate and nitrate deposition on commercial forests Impacts of acidic deposition to commercial freshwater fishing Impacts of acidic deposition to recreation in terrestrial ecosystems Reduced existence values for currently healthy ecosystems Impacts of nitrogen deposition on commercial fishing, agriculture, and forests Impacts of nitrogen deposition on recreation in estuarine ecosystems Damage to ecosystem functions
CO Health	Premature mortality[a]

Pollutant	Unquantified Effects
HC Health[b]	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 Welfare	Direct toxic effects to animals Bioaccumulation in the food chain Damage to ecosystem function Odor

Notes: [a] Premature mortality associated with ozone and carbon monoxide is not separately included in this analysis. In this analysis, we assume that the Pope, et al. C-R function for premature mortality captures both PM mortality benefits and any mortality benefits associated with other air pollutants. [b] Many of the key hydrocarbons related to this rule are also hazardous air pollutants listed in the Clean Air Act.

F. Economic Impact Analysis

We prepared a draft Economic Impact Analysis (EIA) for this rule to estimate the economic impacts of the proposed control program on producers and consumers of nonroad engines, equipment, fuel, and related industries.[243] We received comments on our draft analysis from stakeholders representing agricultural interests, equipment rental and dealer interests, and equipment manufacturers. The commenters conveyed their concerns about our general analytic

[243] This analysis is based on an earlier version of the engineering costs developed for this rule. The final cost estimates for the engine program are slightly higher ($142 million) and the final fuel costs are slightly lower ($246 million), resulting in a 30-year net present value of $27.1 billion (30 year net present values in the year 2004, using a 3 percent discount rate, $2002) or $104 million less than the engineering costs used in this analysis. We do not expect that the revised engineering costs would change the overall results of this economic impact analysis given the small portion of engine, equipment, and fuel costs to total production costs for goods and services using these inputs and given the inelastic value of the estimated demand elasticities for the application markets.

approach and some of the model assumptions. As explained in our responses to these comments, which can be found in the Summary and Analysis of Comments document prepared for this final rule, we do not believe these comments require us to adjust our EIA methodology. We did adjust the methodology, however, to estimate the economic impacts of the fuel sulfur content requirements on the locomotive and marine sectors. As explained below, this revision was necessary to correct an oversight in the draft EIA. We also revised the price and quantity data inputs to the model to make them consistent with the revised engine and fuel cost analyses described earlier in this section.

This section briefly describes the methodology we used to estimate the economic impacts of this final rule, including the model revisions for the marine and locomotive fuel sectors, and the results of that analysis. A detailed description of the Nonroad Diesel Economic Impact Model (NDEIM) prepared for this analysis, the model inputs, and several sensitivity analyses can be found in Chapter 10 of Final Regulatory Impact Analysis prepared for this rule.

1. What is an Economic Impact Analysis?

An Economic Impact Analysis is prepared to inform decision makers within the Agency about the potential economic consequences of a regulatory action. The analysis contains estimates of the social costs of a regulatory program and explores the distribution of these costs across stakeholders. These estimated social costs can then be compared with estimated social benefits (as presented in Section VI.E). 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.[244] In this analysis, social costs are explored in two steps. In the first step, called the *market analysis*, we estimate how prices and quantities of good directly and indirectly affected by the emission control program can be expected to change once the emission control program goes into effect. The estimated price and quantity changes for engines, equipment, fuel, and goods produced using these inputs are examined separately. In the second step, called the *economic welfare analysis*, we look at the total social costs associated with the program and their distribution across stakeholders. The analysis is based on compliance cost estimates and baseline market conditions for prices and quantities of engines, equipment, and fuel produced presented earlier in this section.

In this EIA, we look at price and quantity impacts for engine, equipment, diesel fuel, and goods produced with these inputs. With regard to the goods produced with these inputs, we distinguish between three application markets: agriculture, construction, and manufacturing. It should be noted from the outset that diesel engines, equipment, and fuel represent only a small portion of the total production costs for each of the three application market sectors (the final users of the engines, equipment and fuel affected by this rule). Other more significant production

[244] *EPA Guidelines for Preparing Economic Analyses*, EPA 240-R-00-003, September 2000, p 113.

costs include land, labor, other capital, raw materials, insurance, profits, etc. These other production costs are not affected by this emission control program. This is important because it means that this rule directly affects only a small part of total inputs for the relevant markets. Therefore, the rule is not expected to have a large adverse impact on output and prices of goods produced in the three application sectors.

It should also be noted that our analysis of the impacts on the three application markets is limited to market output. The economic impacts on particular groups of application market suppliers (e.g., the profitability of farm production units or manufacturing or construction firms) or particular groups of consumers (e.g., households and companies that consume agricultural goods, buildings, or durable or consumer goods) are not estimated. In other words, while we estimate that the application markets will bear most of the burden of the regulatory program and we apportion the decrease in application market surplus between application market producers and application market consumers, we do not estimate how those social costs will be shared among specific application market producers and consumers (e.g., farmers and households). In some cases, application market producers may be able to pass most if not all of their increased costs to the ultimate consumers of their products; in other cases, they may be obliged to absorb a portion of these costs. While some commenters requested that we perform a sector-by-sector analysis of application market producers and consumers, we do not believe this is appropriate. The focus on market-level impacts in this analysis is appropriate because the standards in this emission control program are technical standards that apply to nonroad engines, equipment, and fuel regardless of how they are used and the structure of the program does not suggest that different sectors will be affected differently by the requirements. In addition, the results of our EIA suggest that the overall burden on the application market is expected to be small: approximately 0.1 percent increase in prices, on average, and less than 0.02 percent decrease in production, on average. Estimated economic impacts of this size do not warrant performing a sector-by-sector analysis to investigate whether some subsectors may be affected disproportionately.

Finally, as a market-level model, the NDEIM estimates the economic impacts of the rule on the engine, equipment, and application markets and the transportation service sector. It is not a firm-level analysis and therefore the equipment demand elasticity facing any particular manufacturer may be greater than the demand elasticity of the market as a whole. This difference can be important, particularly where the rule affects different firms' costs over different volumes of production. However, to the extent there are differential effects, EPA believes that the wide array of flexibilities provided in this rule are adequate to address any cost inequities that are likely to arise.

2. What methodology did EPA use in this Economic Impact Analysis?

EPA used the same methodology in this final EIA as was used in the draft EIA. The model was revised to accommodate analysis of the locomotive and marine fuel sectors.

a. Conceptual Approach

The Nonroad Diesel Economic Impact Model (NDEIM) uses a multi-market analysis framework that considers interactions between regulated markets and other markets to estimate how compliance costs can be expected to ripple through these markets. In the NDEIM, compliance costs are directly borne by engine manufacturers, equipment manufacturers, petroleum refiners and fuel distributors. Depending on market characteristics, some or all of these compliance costs will be passed on through the supply chain in the form of higher input prices for the application markets (in this case, construction, agriculture, and manufacturing) which in turn affect prices and quantities of goods produced in those application markets. Producers in the application markets adjust their demand for diesel engines, equipment, and fuel in response to these input price changes and consumer demand for application market outputs. This information is passed back to the suppliers of diesel equipment, engines, and fuel in the form of purchasing decisions. The NDEIM explicitly models these interactions and estimates behavioral responses that lead to new equilibrium prices and output for all sectors and the resulting distribution of social costs across the modeled sectors.

b. Markets Examined

The NDEIM uses a multi-market partial equilibrium approach to track changes in price and quantity for 62 integrated product markets, as follows:

- 7 diesel engine markets: less than 25 hp, 26 to 50 hp, 51 to 75 hp, 76 to 100 hp, 101 to 175 hp, 176 to 600 hp, and greater than 600 hp. The EIA includes more horsepower categories than the standards to allow more efficient use of the engine compliance costs estimates. The additional categories also allow estimating economic impacts for a more diverse set of markets.
- 42 diesel equipment markets: 7 horsepower categories within 7 application categories: agricultural, construction, general industrial, pumps and compressors, generator and welder sets, refrigeration and air conditioning, and lawn and garden. There are 7 horsepower/application categories that did not have sales in 2000 and are not included in the model, so the total number of diesel equipment markets is 42 rather than 49.
- 3 application markets: agricultural, construction, and manufacturing.
- 8 nonroad diesel fuel markets: 2 sulfur content levels (15 ppm and 500 ppm) for each of 4 PADDs. PADDs 1 and 3 are combined for the purpose of this analysis. It should be noted that PADD 5 includes Alaska and Hawaii. Also, California fuel volumes that are not affected by the program (because they are covered by separate California nonroad diesel fuel standards) are not included in the analysis.
- 2 transportation service markets: locomotive and marine.

As noted above, this final EIA also estimates the economic impact on two additional markets that were not included in the draft analysis: the locomotive and marine diesel

transportation service markets. In the NPRM, we proposed to set fuel sulfur standards for locomotive and distillate marine diesel as well as for nonroad diesel fuel. We developed cost estimates for these two types of fuel as well as for nonroad diesel fuel. In the draft EIA, however, we did not consider the economic impacts of these fuel costs on the locomotive and marine sectors separately. Instead, we applied all of these additional fuel costs to the manufacturing application market.

In preparing the final RIA for this rule, we determined that it would be more appropriate to consider the impacts of the fuel program on the diesel marine and locomotive sectors separately. This is because the locomotive and marine markets are directly affected by the higher diesel fuel prices associated with the rule. In addition, production and consumption decisions of downstream end-use markets that use these services are influenced by the prices of transportation services. At the same time, locomotive and marine diesel transportation services are not used solely in the three application markets modeled in the NDEIM. These services are also provided to electric utilities (transporting coal to electric power plants), non-manufacturing service industries (public transportation) and governments. We take this into account and report impacts on those sectors separately.

c. Model Methodology

A detailed description of the model methodology, inputs, and parameters used in this economic impact analysis is provided in Chapter 10 of the Final RIA prepared for this rule. The model methodology is firmly rooted in applied microeconomic theory and was developed following the *OAQPS Economic Analysis Resource Document*.[245]

The NDEIM is a computer model comprised of a series of spreadsheet modules that define the baseline characteristics of the supply and demand for the relevant markets and the relationships between them. The model is constructed based on the market characteristics and inter-connections summarized in this section and described in more detail in Chapter 10 of the RIA. The model is shocked by applying the engineering compliance cost estimates to the appropriate market suppliers, and then numerically solved using an iterative auctioneer approach by "calling out" new prices until a new equilibrium is reached in all markets simultaneously. The output of the model is new equilibrium prices and quantities for all affected markets. This information is used to estimate the social costs of the model and how those costs are shared among affected markets.

The NDEIM uses a multi-market partial equilibrium approach to track changes in price and quantity for the modeled product markets. As explained in the *EPA Guidelines for Preparing*

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[245] 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 in Docket A-2001-28, Document No. II-A-14.

Economic Analyses, 'partial' equilibrium refers to the fact that the supply and demand functions are modeled for just one or a few isolated markets and that conditions in other markets are assumed either to be unaffected by a policy or unimportant for social cost estimation. Multi-market models go beyond partial equilibrium analysis by extending the inquiry to more than just a single market. Multi-market analysis attempts to capture at least some of the interactions between markets.[246]

The NDEIM uses an intermediate run time frame. The use of the intermediate run means that some factors of production are fixed and some are variable. This modeling period allows analysis of the economic effects of the rule's compliance costs on current producers. The short run, in contrast, imposes all compliance costs on the manufacturers (no pass-through to consumers), while the long run imposes all costs on consumers (full cost pass-through to consumers). The use of the intermediate run time frame is consistent with economic practices for this type of analysis.

The NDEIM assumes perfect competition in the market sectors. This assumption was questioned by one commenter, who noted that the 25 to 75 hp engine category does not appear to be competitive based on the number of firms in that subsector. Specifically, one firm has nearly 29 percent of the market and the top nine firms have about 88 percent. The remaining twelve percent of this market shared among nineteen other firms. While the commenter is correct in noting the limited number of firms in this subsector, we believe it is still appropriate to rely on the perfect competition assumption in this analysis. The perfect competition assumption relies not only on the number of firms in a market but also on other market characteristics. For example, there are no indications of barriers to entry, the firms in these markets are not price setters, and there is no evidence of high levels of strategic behavior in the price and quantity decisions of the firms. In addition, the products produced within each market are somewhat homogeneous in that engines from one firm can be purchased instead of engines from another firm. Finally, according to contestable market theory, oligopolies and even monopolies will behave very much like firms in a competitive market if it is possible to enter particular markets costlessly (i.e., there are no sunk costs associated with market entry or exit). With regard to the nonroad engine market, production capacity is not fully utilized. This means that manufacturers could potentially switch their product line to compete in another segment of the market without a significant investment. For all these reasons, the number of firms in a particular engine submarket does not prevent us from relying on the perfect competition assumption for that submarket. This is true of other engine and equipment subsectors as well. In addition, changing the assumption of perfect competition based on the limited evidence raised by the commenter would break with widely accepted economic practice for this type of analysis.[247]

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[246] *EPA Guidelines for Preparing Economic Analyses*, EPA 240-R-00-003, September 2000, p. 125-6.

[247] See, for example, *EPA Guidelines for Preparing Economic Analyses*, EPA 240-R-00-003, September 2000, p 126. See also the Final RIA for this rule, Chapter 10, Section 10.2.3.1.

d. Model Inputs - Elasticities

The estimated social costs of this emission control program are a function of the ways in which producers and consumers of the engines, equipment, and fuels affected by the standards change their behavior in response to the costs incurred in complying with the standards. As the compliance costs ripple through the markets, producers and consumers change their production and purchasing decisions in response to changes in prices. In the NDEIM, these behavioral changes are modeled by the demand and supply elasticities (behavioral-response parameters), which measure the price sensitivity of consumers and producers.

The supply elasticities for the equipment, engine, diesel fuel, and transportation service markets and the demand and supply elasticities for the application markets used in the NDEIM were obtained from peer-reviewed literature sources or were estimated using econometric methods. These econometric methods are well-documented and are consistent with generally accepted econometric practice. Appendix 10H of the RIA contains detailed information on how the elasticities were estimated.

The equipment and engine supply elasticities are elastic, meaning that quantities supplied are expected to be fairly sensitive to price changes. The supply elasticities for the fuel, transportation, and application markets are inelastic or unit elastic, meaning that the quantity supplied/demanded is expected to be fairly insensitive to price changes or will vary one-to-one with price changes. The demand elasticities for the application markets are also inelastic. This is consistent with the Hicks-Allen derived demand relationship, according to which a low cost-share in production combined with limited substitution yields inelastic demand.[248] As noted above, diesel engines, equipment, and fuel represent only a small portion of the total production costs for each of the three application sectors. The limited ability to substitute for these inputs is discussed below.

In contrast to the above, the demand elasticities for the engine, equipment, fuel, and transportation markets are internally derived as part of the process of running the model. This is an important feature of the NDEIM, which allows it to link the separate market components of the model and simulate how compliance costs can be expected to ripple through the affected economic sectors. In the real world, for example, the quantity of nonroad equipment units produced in a particular period depends on the price of engines (the engine market) and the demand for equipment (the application markets). Similarly, the number of engines produced

[248] If the elasticity of demand for a final product is less than the elasticity of substitution between an input and other inputs to the final product, then the demand for the input is less elastic the smaller its cost share. Hicks, J.R., 1961. Marshall's Third Rule: A Further Comment. Oxford Economic Papers 13:262-65; Hicks, J.R., 1963. The Theory of Wages. St. Martins Press, NY, pp. 233-247. See Docket A-2001-28, Document No. IV-B-25 for relevant excerpts. See Docket A-2001-28, Document No. IV-B-25 for relevant excerpts.

depends on the demand for engines (the equipment market) which depends on the demand for equipment (the application markets). Changes in conditions in one of these markets will affect the others. By designing the model to derive the engine, equipment, transportation market, and fuel demand elasticities, the NDEIM simulates these connections between supply and demand among all the product markets and replicates the economic interactions between producers and consumers.

e. Model Inputs - Fixed and Variable Costs

The EIA treats the fixed costs expected to be incurred by engine and equipment manufacturers differently in the market and social costs analyses. This feature of the model is described in greater detail in Section 10.2.3.3 of the RIA. In the market analysis, estimated engine and equipment market impacts (changes in prices and quantities) are based solely on the expected increase in variable costs associated with the standards. Fixed costs are not included in the market analysis reported in Table VI-F-1 because in an analysis of competitive markets the industry supply curve is based on its marginal cost curve and fixed costs are not reflected in changes in the marginal cost curve. In addition, the fixed costs associated with the rule are primarily R&D costs for design and engineering changes. Firms in the affected industries currently allocate funds for R&D programs and this rule is not expected to lead firms to change the size of their R&D budgets. Therefore, changes in fixed costs for engine and equipment redesign associated with this rule are not likely to affect the prices of engines or equipment. Fixed costs are included in the social cost analysis reported in Table VI-F-2, however, as an additional cost to producers. This is appropriate because even though firms currently allocated funds to R&D those resources are intended for other purposes such as increasing engine power, ease of use, or comfort. These improvements will therefore be postponed for the length of the rule-related R&D program. This is a cost to society.

One commenter recommended that EPA include engine and equipment R&D (fixed) costs in the market analysis. This commenter argued that while in the long run total costs are not determined by changes in fixed costs, total costs are determined initially by both fixed and variable costs. This commenter was concerned that by not including fixed costs, EPA's analysis underestimates the increase in the average price of goods and services produced using engines affected by the rule. In fact, we included R&D costs in a sensitivity analysis performed for the draft EIA, which has been updated and can be found in Appendix I to Chapter 10 of the Final RIA. Including fixed costs results in a transfer of economic welfare losses from engine and equipment markets to the application markets (engine and equipment producer surplus losses decrease; consumer surplus losses increase), but does not change the overall economic welfare losses associated with the rule.

Unlike for engines and equipment, most of the petroleum refinery fixed costs are for production hardware. Refiners are expected to have to make physical changes to their refineries and purchase additional equipment to produce 500 ppm and then 15 ppm fuel. Therefore, fixed costs are included in the market analysis for fuel price and quantity impacts.

f. Model Inputs - Substitution by Application Suppliers

In modeling the market impacts and social costs of this rule, the NDEIM considers only diesel equipment and fuel inputs to the production of goods in the applications markets. It does not explicitly model alternate production inputs that would serve as substitutes for new nonroad equipment or nonroad diesel fuel. In the model, market changes in the final demand for application goods and services directly correspond to changes in the demand for nonroad equipment and fuel (i.e., in normalized terms there is a one-to-one correspondence between the quantity of the final goods produced and the quantity of nonroad diesel equipment and fuel used as inputs to that production). We believe modeling the market in this manner is economically sound and reflects the general experience for the nonroad market.

Some commenters suggested that the NDEIM should consider substitution to alternate means of production such as pre-buying, delayed buying, extending the life of a current machine, and substituting with different (e.g., gasoline-powered) equipment. These commenters did not provide detailed explanations for their comments or data in support of their substitution arguments. After considering these comments, we conclude that revising the NDEIM to include these effects would be inappropriate.

The term "pre-buying" appears to refer to the possibility that the suppliers in the application market may choose to buy additional unneeded quantities of nonroad equipment prior to the beginning of the Tier 4 program, thus avoiding the higher cost for the Tier 4 equipment. It should be noted that this effect is limited to equipment and does not extend to nonroad diesel fuel. We believe that equipment pre-buying will not be economically viable in most cases due to the cost of holding capital (equipment) idle and of maintaining unused equipment. Such strategic purchases, if they occur at all, would be limited to a period of a few months before the effective date of the standards. The NDEIM models market reactions in the intermediate time frame, beyond the scope of any potential pre-buy. For these reasons, we do not believe it is appropriate to revise the model to include pre-buy as a means of substitution in NDEIM.

"Delayed-buying" appears to refer to the possibility that suppliers in the application market would defer purchasing new equipment initially but would eventually make those purchases. Similarly to pre-buying, this appears to be a short-term effect and would therefore be inappropriate to include in an economic model designed to model the intermediate time frame.

Extending the life of a current machine is suggested as another alternative to purchasing new equipment. We believe this would also be a short term phenomena that is not relevant for the intermediate time frame of the NDEIM. Based on our meetings with equipment users and suppliers, we do not believe that extending the life of nonroad equipment will prove to be an economically viable substitute in the near or long term. Most users of nonroad equipment already extend the life of their equipment to the maximum extent possible and purchase new equipment only when the existing equipment can no longer perform its function, when new demand for production requires additional means for production, or when new equipment offers a cheaper

means of production than existing equipment. This situation is not expected to change as a result of this rule. In addition, even if it were possible to extend equipment life even more, this would lower the cost of nonroad equipment as an input to production (because it would be less expensive to maintain old equipment than purchase new equipment) and thus would reduce the economic impact of the Tier 4 program compared to our estimate. For all of the reasons stated here, we have decided not to attempt to model an extended equipment life alternative in the NDEIM.

Finally, some commenters noted that equipment users may chose to substitute with different equipment, particularly gasoline-powered equipment. We believe substitution to gasoline-powered equipment is an alternative only for the smaller power categories (below 75 hp). Based on discussions with equipment manufacturers and users, the dominant reasons for choosing diesel engines over the substantially less expensive gasoline engines include better performance from diesel engines, lower fuel consumption from diesel engines, and the ability to use diesel fuel. The use of diesel fuel is preferable for two reasons: it is safer to store and dispense, and it is compatible with the fuel needed for larger equipment at the same worksite. Where these issues are not a concern, gasoline engines already enjoy a substantial economic advantage over diesel. We do not believe that the incremental increase in new equipment cost associated with this program would provide the necessary economic incentives for switching to gasoline equipment. Equipment users who can use gasoline-fueled equipment already do so, while those who can't due to the high costs of storing and dispensing gasoline fuel already use diesel engines. Therefore, we have not attempted to model the possibility of substitution to gasoline equipment in NDEIM.

g. Model Inputs - Other

Compliance Costs. The NDEIM uses the estimated engine, equipment, and fuel compliance costs described in above and presented in Chapters 6 and 7 of the RIA. Engine and equipment costs vary over time because fixed costs are recovered over five to ten year periods while total variable costs, despite learning effects that serve to reduce costs on a per unit basis, continue to increase at a rate consistent with new sales increases. Similarly, engine operating costs also vary over time because oil change maintenance savings, PM filter maintenance, and fuel economy effects, all of which are calculated on the basis of gallons of fuel consumed, change over time consistent with the growth in nationwide fuel consumption. Fuel-related compliance costs (costs for refining and distributing regulated fuels) also change over time. These changes are more subtle than the engine costs, however, as the fuel provisions are largely implemented in discrete steps instead of phasing in over time. Compliance costs were developed on a ¢/gallon basis; total compliance costs are determined by multiplying the ¢/gallon costs by the relevant fuel volumes. Therefore, total fuel costs increase as the demand for fuel increases. The variable operating costs are based on the natural gas cost of producing hydrogen and for heating diesel fuel for the new desulfurization equipment, and thus would fluctuate along with the price of natural gas.

Operating Savings. Operating savings refers to changes in operating costs that are expected to be realized by users of both existing and new nonroad diesel equipment as a result of

the reduced sulfur content of nonroad diesel fuel. These include operating savings (cost reductions) due to fewer oil changes, which accrue to nonroad, marine and locomotive engines that are already in use as well as new nonroad engines that will comply with the standards (see Section VI.B). These also include any extra operating costs associated with the new PM emission control technology which may accrue to certain new engines that use this technology. Operating savings are not included in the market analysis because some of the savings accrue to existing engines and because, as explained in Section VI.C.1.c, these savings are not expected to affect consumer decisions with respect to new engines. Operating savings are included in the social cost analysis, however, because they accrue to society. They are added into the estimated social costs as an additional savings to the application and transportation service markets, since it is the users of these engines and fuels who will see these savings. A sensitivity analysis was performed as part of this EIA that includes the operating savings in the market analysis. The results of this sensitivity analysis are presented in Appendix 10.I.

Fuel Marker Costs. Fuel marker costs refers to costs associated with marking high sulfur heating oil to distinguish it from high sulfur diesel fuel produced after 2007 through the use of early sulfur credits or small refiner provisions. Only heating oil sold outside of the Northeast is affected. The higher sulfur NRLM fuel is not allowed to be sold in most of the Northeast, so the marker need not be added in this large heating oil market. These costs are expected to be about $810,000 in 2007, increasing to $1.38 million in 2008, but steadily decreasing thereafter to about $940,000 in 2040 (see Chapter 10 of the RIA). Because these costs are relatively small, they are incorporated into the estimated compliance costs for the fuel program (see discussion of fuel costs, above). They are therefore not counted separately in this economic impact analysis. This means that the costs of marking heating fuel are allocated to all users of the fuel affected by this rule (nonroad, locomotive, and marine) instead of uniquely to heating oil users. This is a reasonable approach since it is likely that refiners will pass the marker costs along their complete nonroad diesel product line and not just to heating oil.

Fuel Spillover. Spillover fuel is highway grade diesel fuel consumed by nonroad equipment, stationary diesel engines, boilers, and furnaces. As described in Section 7.1 of Chapter 7 of the final RIA, refiners are expected to produce more 15 ppm fuel than is required for the highway diesel market. This excess 15 ppm fuel will be sold into markets that allow fuel with a higher sulfur level (i.e., nonroad for a limited period of time, locomotive, marine diesel and heating oil). This spillover fuel is affected by the diesel highway rule and is not affected by this regulation. Therefore, it is important to differentiate between spillover and nonspillover fuel to ensure that the compliance costs for that fuel pool are not counted twice. In the NDEIM, this is done by incorporating the impact of increased fuel costs associated with the highway rule prior to analysis of the final nonroad rule (see RIA Section 10.3.8).

Compliance Flexibility Provisions. Consistent with the engine and equipment cost discussion in Section VI.C, the EIA does not include any cost savings associated with the equipment transition flexibility program or the nonroad engine ABT program. As a result, the results of this EIA can be viewed as somewhat conservative.

Locomotive and Marine Fuel Costs. The locomotive and marine transportation sectors are affected by this rule through the sulfur limits on the diesel fuel used by these engines. These sectors provide transportation to the three application markets as well as to other markets not considered in the NDEIM (e.g., public utilities, nonmanufacturing service industries, government). As explained in Section 10.3.1.5 of the RIA, the NDEIM applies only a portion of the locomotive and marine fuel costs to the three application markets. The rest of the locomotive and marine fuel costs are added as a separate item to the total social cost estimates (as Application Markets Not Included in NDEIM).

3. What Are the Results of this Analysis?

Using the revised cost data described earlier in this section and the NDEIM described above and in Chapter 10 of the Final RIA, we estimated the economic impacts of the nonroad engine, equipment and fuel control program. Economic impact results for 2013, 2020, 2030, and 2036 are presented in this section. The first of these years, 2013, corresponds to the first year in which the standards affect all engines, equipment, and fuels. It should be noted that, as illustrated in Table VI-F-3, aggregate program costs peak in 2014; increases in costs after that year are due to increases in the population of engines over time. The other years, 2020, 2030 and 2036, correspond to years analyzed in our benefits analysis. Detailed results for all years are included in the appendices to Chapter 10 of the RIA.

In the following discussion, social costs are computed as the sum of market surplus offset by operating savings. Market surplus is equal to the aggregate change in consumer and producer surplus based on the estimated market impacts associated with the rule. As explained above, operating savings are not included in the market analysis but instead are listed as a separate category in the social cost results tables.

In considering the results of this analysis, it should be noted that the estimated output quantities for diesel engines, equipment, and fuel are not identical to those estimated in the engineering cost described in above and presented in Chapters 6 and 7 of the RIA. The difference is due to the different methodologies used to estimate these costs. As noted above, social costs are the value of goods and services lost by society resulting from a) the use of resources to comply with and implement a regulation (i.e., compliance costs) and b) reductions in output. Thus, the social cost analysis considers both price and output (quantity) effects associated with consumer and producer reaction to increased prices associated with the regulatory compliance costs. The engineering cost analysis, on the other hand, is based on applying additional technology to comply with the new regulations. The engine population in the engineering cost analysis does not reflect consumer and producer reactions to the compliance costs. Consequently, the estimated output quantities from the cost analysis are slightly larger than the estimated output quantities from the social cost analysis.

The results of this analysis suggest that the economic impacts of this rule are likely to be small, on average. Price increases in the application markets are expected to average about 0.1

percent per year. Output decrease in the application markets are expected average less than 0.02 percent for all years. The price increases for engines, equipment, and fuel are expected to be about 20 percent, 3 percent, and 7 percent, respectively (total impact averaged over the relevant years). The number of engines and equipment produced is expected to decrease by less than 250 units, and the amount of fuel produced annually is expected to decrease by less than 4 million gallons. With respect to the economic welfare analysis, producers and consumers in the application markets are expected to bear about 83 percent of the burden in 2013; this will increase to about 96 percent in 2030 and beyond. In other words, despite the almost total pass-through of costs the average price of goods and services in the application markets is expected to increase by only 0.1 percent. This outcome reflects the fact that diesel engines, equipment, and fuel are only a small part of total costs for the application markets. These results are described in more detail below and in Chapter 10 of the Final RIA.

a. Expected Market Impacts

The estimated market impacts for 2013, 2020, and 2030 are presented in Table VI.F-1. The market-level impacts presented in this table represent production-weighted averages of the individual market-level impact estimates generated by the model: the average expected price increase and quantity decrease across all of the units in each of the engine, equipment, fuel, and final application markets. For example, the model includes seven individual engine markets that reflect the seven different horsepower size categories. The 21.4 percent price change for engines shown in Table VI.F-1 for 2013 is an average price change across all engine markets weighted by the number of production units. Similarly, the equipment impacts presented in Table VI.F-1 are the weighted averages of 42 equipment-application markets, such as small (< 25hp) agricultural equipment and large (>600hp) industrial equipment. Note that price increases and quantity decreases for specific types of engines, equipment, application sectors, or diesel fuel markets are likely to be different. The aggregated data presented in this table provide a broad overview of the expected market impacts that is useful when considering the impacts of the rule on the economy as a whole. The individual market-level impacts are presented in Chapter 10 of the Final RIA.[249]

The market impacts of this rule suggest that the overall economic impact of the emission control program on society is expected to be small, on average. According to this analysis, the average prices of goods and services produced using equipment and fuel affected by the rule are expected to increase by about 0.1 percent (as noted above), despite the almost total pass-through of compliance costs to those markets.

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[249] The NDEIM distinguishes between “merchant” engines and “captive” engines. “Merchant” engines are produced for sale to another company and are sold on the open market to anyone who wants to buy them. “Captive” engines are produced by a manufacturer for use in its own nonroad equipment line (this equipment is said to be produced by “integrated” manufacturers). The market analysis for engines includes compliance costs for merchant engines only. The market analysis for equipment includes equipment compliance costs plus a portion of the engine compliance costs attributable to captive engines.

Engine Market Results: This analysis suggests that most of the variable costs associated with the rule will be passed along in the form of higher prices. The average price increase in 2013 for engines is estimated to be about 21.4 percent. This percentage is expected to decrease to about 18.3 percent by 2020. In 2036, the last year considered, the average price increase is expected to be about 18.2 percent. This expected price increase varies by engine size because compliance costs are a larger share of total production costs for smaller engines. In 2013, the largest expected percent price increase is for engines between 25 and 50 hp: 29 percent or $850; the average price for an engine in this category is about $2,900. However, this price increase is expected to drop to 22 percent, or about $645, for 2015 and later. The smallest expected percent price increase in 2013 is for engines in the greater than 600 hp category. These engines are expected to see price increases of about 3 percent increase in 2013, increasing to about 7.6 percent in 2015 and then decreasing to about 6.6 percent in 2017 beyond. The expected price increase for these engines is about $2,240 in 2013, increasing to about $6,150 in 2015 and then decreasing to $5,340 in 2017 and later, for engines that cost on average about $80,500.

The market impact analysis predicts that even with these increased in engine prices, total demand is not expected to change very much. The expected average change in quantity is less than 150 engines per year, out of total sales of more than 500,000 engines. The estimated change in market quantity is small because as compliance costs are passed along the supply chain they become a smaller share of total production costs. In other words, firms that use these engines and equipment will continue to purchase them even at the higher cost because the increase in costs will not have a large impact on their total production costs (diesel equipment is only one factor of production for their output of construction, agricultural, or manufactured goods).

Equipment Market Results: Estimated price changes for the equipment markets reflect both the direct costs of the new standards on equipment production and the indirect cost through increased engine prices. In general, the estimated percentage price changes for the equipment are less than that for engines because the engine is only one input in the production of equipment. In 2013, the average price increase for nonroad diesel equipment is estimated to be about 2.9 percent.[250] This percentage is expected to decrease to about 2.5 percent for 2020 and beyond. The range of estimated price increases across equipment types parallels the share of engine costs relative to total equipment price, so the estimated percentage price increase among equipment types also varies. For example, the market price in 2013 for agricultural equipment between 175 and 600 hp is estimated to increase about 1.2 percent, or $1,740 for equipment with an average cost of $143,700. This compares with an estimated engine price increase of about $1,700 for engines of that size. The largest expected price increase in 2013 for equipment is $2,290, or 2.6

[250] It should be noted that the equipment prices used in this analysis reflect current market conditions. An increase in equipment prices associated with the nonroad Tier 3 standards would reduce size of the percentage increase in price. In this sense, our Economic Impact Analysis is conservative as it is based on the impact of the Tier 4 program on Tier 1 and Tier 2 equipment prices and therefore overestimates the market impacts of the Tier 4 program.

percent, for pumps and compressors over 600 hp. This compares with an estimated engine price increase of about $2,240 for engines of that size. The smallest expected price increase in 2013 for equipment is $120, or 0.7 percent, for construction equipment less than 25 hp. This compares with an estimated engine price increase of about $120 for engines of that size.

Again, the market analysis predicts that even with these increased equipment prices total demand is not expected to change very much. The expected average change in quantity is less than 250 pieces of equipment per year, out of a total sales of more than 500,000 units. The average decrease in the quantity of nonroad diesel equipment produced as a result of the regulation is estimated to be about 0.02 percent for all years. The largest expected decrease in quantity in 2013 is 18 units of construction equipment per year for construction equipment between 100 and 175 hp, out of about 63,000 units. The smallest expected decrease in quantity in 2013 is less than one unit per year in all hp categories of pumps and compressors.

It should be noted that the absolute change in the number of engines and equipment does not match. This is because the absolute change in the quantity of engines represents only engines sold on the market. Reductions in engines consumed internally by integrated engine/equipment manufacturers are not reflected in this number but are captured in the cost analysis.

Table VI.F-1. –
Summary of Market Impacts ($2002)

Market	Engineering Cost	Change in Price		Change in Quantity	
	Per Unit	Absolute ($million)	Percent	Absolute	Percent
2013					
Engines	$1,052	$821	21.4	–79[a]	–0.014
Equipment	$1,198	$975	2.9	–139	–0.017
Loco/Marine Transp[b]			0.009		–0.007
Application Markets[b]			0.097		–0.015
No. 2 Distillate Nonroad	$0.06	$0.07	6.0	–2.75[c]	–0.019
2020					
Engines	$950	$761	18.3	–98[a]	–0.016
Equipment	$1,107	$976	2.5	–172	–0.018
Loco/Marine Transp[b]			0.01		–0.008
Application Markets[b]			0.105		–0.017
No. 2 Distillate Nonroad	$0.07	$0.07	7.0	–3.00[c]	–0.021
2030					
Engines	$937	$751	18.2	–114[a]	–0.016
Equipment	$968	$963	2.5	–200	–0.018
Loco/Marine Transp[b]			0.010		–0.008
Application Markets[b]			0.102		–0.016
No. 2 Distillate Nonroad	$0.07	$0.07	7.0	–3.53[c]	–0.022
2036					
Engines	$931	$746	18.2	–124[a]	–0.016
Equipment	$962	$956	2.5	–216	–0.018
Loco/Marine Transp[b]			0.010		–0.008
Application Markets[b]			0.101		–0.016
No. 2 Distillate Nonroad	$0.07	$0.07	7.0	–3.85[c]	–0.022

Notes:
[a] The absolute change in the quantity of engines represents only engines sold on the market. Reductions in engines consumed internally by integrated engine/equipment manufacturers are not reflected in this number but are captured in the cost analysis. For this reason, the absolute change in the number of engines and equipment does not match.
[b] The model uses normalized commodities in the application markets because of the great heterogeneity of products. Thus, only percentage changes are presented.
[c] Units are in million of gallons.

Transportation Market Results: The estimated price increase associated with the proposed standards in the locomotive and marine transportation markets is negligible, at 0.01 percent for all years. This means that these transportation service providers are expected to pass along nearly all of their increased costs to the agriculture, construction, and manufacturing application markets, as well as other application markets not explicitly modeled in the NDEIM. This price increases represent a small share of total application market production costs, and therefore are not expected to affect demand for these services.

Application Market Results: The estimated price increase associated with the new standards in all three application markets is very small and averages about 0.1 percent for all years. In other words, on average, the prices of goods and services produced using the affected engines, equipment, and fuel are expected to increase negligibly. This results from the observation that compliance costs passed on through price increases represent a very small share of total production costs in all the application markets. For example, the construction industry realizes an increase in production costs of approximately $580 million in 2013 because of the price increases for diesel equipment and fuel. However, this represents less than 0.001 percent of the $820 billion value of shipments in the construction industry in 2000. The estimated average commodity price increase in 2013 ranges from 0.08 percent in the manufacturing application market to about 0.5 percent in the construction market. The percentage change in output is also estimated to be very small and averages less than 0.02 percent for all years. Note that these estimated price increases and quantity decreases are average for these sectors and may vary for specific subsectors. Also, note that absolute changes in price and quantity are not provided for the application markets in Table VI.F-1 because normalized commodity values are used in the market model. Because of the great heterogeneity of manufactured or agriculture products, a normalized commodity ($1 unit) is used in the application markets. This has no impact on the estimated percentage change impacts but makes interpretation of the absolute changes less informative.

Fuel Markets Results: The estimated average price increase across all nonroad diesel fuel is about 7 percent for all years. For 15 ppm fuel, the estimated price increase for 2013 ranges from 5.6 percent in the East Coast region (PADD 1&3) to 9.1 percent in the mountain region (PADD 4). The average national output decrease for all fuel is estimated to be about 0.02 percent for all years, and is relatively constant across all four regional fuel markets.

b. Expected Economic Welfare Impacts

Estimated social costs are presented in Table VI.F-2. In 2013, the total social costs are projected to be about $1,510 million ($2002). About 83 percent of the total social costs is expected to be borne by producers and consumers in the application markets in 2013, indicating that the majority of the compliance costs associated with the rule are expected to be passed on in the form of higher prices. When these estimated impacts are broken down, about 58.5 percent of the social costs are expected to be borne by consumers in the application markets and about 41.5 percent are expected to be borne by producers in the application markets. Equipment manufacturers are expected to bear about 9.5 percent of the total social costs. Engine manufacturers and diesel fuel refineries are expected to bear 2.8 percent and 0.5 percent, respectively. The remaining 4.2 percent of the social costs is expected to be borne by the locomotive and marine transportation service sector. In this last sector, about 97 percent of the gross decrease in market surplus is expected to be borne by the application markets that are not included in the NDEIM but that use these services (e.g., public utilities, nonmanufacturing service industries, government) while about 3 percent is expected to be borne by locomotive and marine service providers. Because of the way the NDEIM is structured, with the fuel savings added separately, the results imply that locomotive and marine service provides would see net benefits from the rule due to the operating savings associated with low sulfur fuel. In fact, they are likely to pass along some or all of those operating savings to the users of their services, reducing the size of the welfare losses for those users.

Total social costs continue to increase over time and are projected to be about $2,046 million by 2030 and $2,227 million in 2036 ($2002). The increase is due to the projected annual growth in the engine and equipment populations. Producers and consumers in the application markets are expected to bear an even larger portion of the costs, approximately 96 percent. This is consistent with economic theory, which states that, in the long run, all costs are passed on to the consumers of goods and services.

The present value of total social costs through 2036, contained in Table VI.F-3, is estimated to be $27.2 billion ($2002). This present value is calculated using a social discount rate of 3 percent from 2004 through 2036. We also performed an analysis using a 7 percent social discount rate. Using that discount rate, the present value of the social costs through 2036 is estimated to be $13.9 billion ($2002). As shown in Table VI.F-3, these results suggest that total engineering costs exceed compliance costs by a small amount. This is due primarily to the fact that the estimated output quantities for diesel engines, equipment, and fuel are not identical to those estimated in the engineering cost analysis, which is due to the different methodologies used to estimate these costs (see previous discussion in this Section IV.F.3).

Table VI.F-2. –

Summary of Social Costs Estimates Associated with Primary Program

2015, 2020, 2030, and 2036 ($2002, $Million)[a,b]

2013				
	Market Surplus (10^6)	Operating Savings (10^6)	Total	Percent
Engine Producers Total	**$42.0**		**$42.0**	**2.8%**
Equipment Producers Total	**$143.1**		**$143.1**	**9.5%**
Construction Equipment	$64.0		$64.0	
Agricultural Equipment	$51.8		$51.8	
Industrial Equipment	$27.2		$27.2	
Application Producers & Consumers Total	**$1,496.7**	**($243.2)**	**$1,253.5**	**83.0%**
Total Producer	*$620.9*			*41.5%*
Total Consumer	*$875.7*			*58.5%*
Construction	$584.3	($115.2)	$469.2	
Agriculture	$430.0	($78.2)	$351.8	
Manufacturing	$482.4	($49.8)	$432.5	
Fuel Producers Total	**$8.0**		**$8.0**	**0.5%**
PADD I&III	$4.1		$4.1	
PADD II	$3.3		$3.3	
PADD IV	$0.0		$0.0	
PADD V	$0.6		$6.0	
Transportation Services, Total	**$104.9**	**($41.5)**	**$63.4**	**4.2%**
Locomotive	$1.6	($12.4)	($10.8)	
Marine	$0.9	($9.9)	($9.0)	
Application markets not included in NDEIM	$102.4	($19.2)	$83.2	
Total	$1,794.7	($284.7)	$1,510.0	100.0%

2020				
	Market Surplus (10^6)	Operating Savings (10^6)	Total	Percent
Engine Producers Total	**$0.1**		**$0.1**	**0.0%**
Equipment Producers Total	**$122.7**		**$122.7**	**6.7%**
Construction Equipment	$57.8		$57.8	
Agricultural Equipment	$39.7		$39.7	
Industrial Equipment	$25.2		$25.2	
Application Producers & Consumers Total	**$1,826.1**	**($192.3)**	**$1,633.8**	**89.4%**
Total Producer	*$762.2*			*41.7%*
Total Consumer	*$1,063.8*			*58.3%*
Construction	$744.0	($91.1)	$653.0	
Agriculture	$524.3	($61.8)	$462.5	

Manufacturing	$557.8	($39.4)	$518.3	
Fuel Producers Total	**$11.2**		**$11.2**	**0.6%**
PADD I&III	$5.6		$5.6	
PADD II	$4.6		$4.6	
PADD IV	$0.2		$0.2	
PADD V	$0.8		$0.8	
Transportation Services, Total	**$95.7**	**($35.1)**	**$60.6**	**3.3%**
Locomotive	$2.0	($7.2)	($5.2)	
Marine	$1.1	($11.6)	($10.5)	
Application markets not included in NDEIM	$92.6	($16.3)	$76.3	
Total	$2,055.7	($227.4)	$1,828.3	100.0%
	2030			
Engine Producers Total	**$0.1**		**$0.1**	**0.0%**
Equipment Producers Total	**$5.9**		**$5.9**	**0.3%**
Construction Equipment	$4.0		$4.0	
Agricultural Equipment	$1.9		$1.9	
Industrial Equipment	$0.1		$0.1	
Application Producers & Consumers Total	**$2,112.3**	**($154.2)**	**$1,958.1**	**95.7%**
Total Producer	*$882.2*			*41.7%*
Total Consumer	*$1,230.1*			*58.3%*
Construction	$863.8	($73.0)	$790.8	
Agriculture	$606.8	($49.6)	$557.2	
Manufacturing	$641.6	($31.6)	$610.0	
Fuel Producers Total	**$13.2**		**$13.2**	**0.6%**
PADD I&III	$6.7		$6.7	
PADD II	$5.2		$5.2	
PADD IV	$0.3		$0.3	
PADD V	$1.0		$1.0	
Transportation Services, Total	**$109.1**	**($39.9)**	**$69.2**	**3.4%**
Locomotive	$2.5	($7.8)	($5.3)	
Marine	$1.4	($13.6)	($12.2)	
Application markets not included in NDEIM	$105.2	($18.5)	$86.7	
Total	$2,240.6	($194.1)	$2,046.4	100.0%
	2036			
	Market Surplus (10^6)	Operating Savings (10^6)	Total	Percent
Engine Producers Total	**$0.2**		**$0.2**	**0.0%**

Equipment Producers Total	**$6.4**		**$6.4**	**0.3%**
Construction Equipment	$4.3		$4.3	
Agricultural Equipment	$2.0		$2.0	
Industrial Equipment	$0.1		$0.1	
Application Producers & Consumers Total	**$2,287.4**	**($155.7)**	**$2,131.7**	**95.7%**
Total Producer	*$955.5*			*41.7%*
Total Consumer	*$1,331.9*			*58.3%*
Construction	$936.4	($50.0)	$862.7	
Agriculture	$657.8	($73.7)	$607.8	
Manufacturing	$693.2	($31.9)	$661.3	
Fuel Producers Total	**$14.5**		**$14.5**	**0.7%**
PADD I&III	$7.3		$7.3	
PADD II	$5.8		$5.8	
PADD IV	$0.3		$0.3	
PADD V	$1.0		$1.0	
Transportation Services, Total	**$116.9**	**($42.6)**	**$74.3**	**3.3%**
Locomotive	$2.8	($8.2)	($5.4)	
Marine	$1.6	($14.6)	($13.0)	
Application markets not included in NDEIM	$112.5	($19.8)	$92.7	
Total	$2,425.3	($198.4)	$2,227.0	100.0%

Notes: [a] Figures are in 2002 dollars. [b] Operating savings are shown as negative costs.

Table VI.F-3. – National Engineering Compliance Costs and Social Costs Estimates for the Rule (2004 - 2036) ($2002; $Million)

Year	Engineering Compliance Costs	Total Social Costs
2004	$0	$0
2005	$0	$0
2006	$0	$0
2007	($17)	($18)
2008	$54	$54
2009	$54	$54
2010	$328	$327
2011	$923	$922
2012	$1,305	$1,304
2013	$1,511	$1,510
2014	$1,691	$1,690
2015	$1,742	$1,741
2016	$1,743	$1,743
2017	$1,763	$1,762
2018	$1,778	$1,778
2019	$1,795	$1,795
2020	$1,829	$1,828
2021	$1,816	$1,815
2022	$1,819	$1,818
2023	$1,844	$1,843
2024	$1,858	$1,857
2025	$1,888	$1,887
2026	$1,921	$1,920
2027	$1,954	$1,952
2028	$1,985	$1,984
2029	$2,017	$2,016
2030	$2,047	$2,046
2031	$2,078	$2,077
2032	$2,108	$2,107
2033	$2,139	$2,137
2034	$2,169	$2,167
2035	$2,198	$2,197
2036	$2,228	$2,227
NPV at 3%	$27,247	$27,232
NPV at 7%	$13,876	$13,868

VII. Alternative Program Options Considered

Our final emission control program for nonroad engines and equipment consists of a two-step program to reduce the sulfur content of nonroad diesel fuel in conjunction with Tier 4 engine standards. The rule also contains limits on sulfur levels in locomotive and marine diesel fuel. As described in the draft Regulatory Impact Analysis for the proposal, we evaluated a number of alternative options with regard to the scope, level, and timing of the standards. This section presents a summary of those alternative program options and our reasons for either adopting or not adopting these options.

A. Summary of Alternatives

For our Notice of Proposed Rulemaking (NPRM), we developed emissions, benefits, and cost analyses for a number of alternative program options involving variations in both the fuel and engine programs. The alternatives we considered can be categorized according to the structure of their fuel requirements: whether the 15 ppm fuel sulfur limit for nonroad diesel fuel is reached in two steps, like the program we are finalizing today, or in one step. Within each of these two broad fuel program categories, we considered a number of different engine programs. This section summarizes the alternatives. A more detailed description of the alternatives can be found in the NPRM and the draft RIA.

One-step alternatives were those in which the 15 ppm fuel sulfur standard for nonroad diesel fuel is applied in a single step. We evaluated three one-step alternatives, summarized in table VII-1. Option 1 represented an engine program that was similar to that in our proposed program, the primary difference being the generally earlier phase-in dates for the PM standards. We considered the Option 1 engine program as being the most stringent one-step program that could be considered even potentially feasible considering cost, lead-time, and other factors. Option 1 also included a June 2008 start date for the 15 ppm sulfur standard applicable to nonroad diesel fuel and the 500 ppm sulfur standard applicable to locomotive and marine fuel. We also considered two other one-step alternatives which differ from Option 1. As described in table VII-1, Option 1b differed from Option 1 regarding the timing of the fuel standards, while Option 1a differed from Option 1 in terms of the engine standards. Options 1a and 1b also differed from Option 1 by extending the 15 ppm fuel sulfur limit to locomotive and marine diesel fuel.

Two-step alternatives were those in which the nonroad diesel fuel sulfur standard was set first at 500 ppm and then was reduced to 15 ppm. The two-step alternatives varied from the proposed program in terms of both the timing and levels of the engine standards and the timing of the fuel standards. Option 2a was the same as the proposed program except the 500 ppm fuel standard was introduced a year earlier, in 2006. Option 2b was the same as the proposed program except the 15 ppm fuel standard was introduced a year earlier (in 2009) and the trap-based PM standards began earlier for all engines. Option 2c was the same as the proposed program except the 15 ppm fuel standard was introduced a year earlier in 2009 and the trap-based PM standards began earlier for engines 175-750 hp. Option 2d was the same as the proposed program except

the NO_X standard was reduced to 0.30 g/bhp-hr for engines of 25-75 hp, and this standard was phased in. Finally, Option 2e was the same as the proposed program except there were no new Tier 4 NO_X limits.

In the NPRM, option 3 was identical to the proposed program, except that it would have exempted mining equipment over 750 hp from the Tier 4 standards. We explained in detail in section 12.6.2.2.7 of the draft RIA that we had very serious reservations regarding the legality of this option given these engines' high emission rates of PM, NO_X and NMHC and the availability of further emissions control at reasonable cost. We adhere to these conclusions here. We do note, however, that we are adopting somewhat different provisions for this engine category than we proposed. As explained in sections II.A. and II.B above, although we have adopted aftertreatment-based PM standards for these engines, the standards are slightly higher than those proposed to assure their technical feasibility. We also have deferred a decision on whether to adopt aftertreatment-based standards for NO_X for mobile machines with engines greater than 750 hp. We also have provided ample lead time for these engines to comply with the Tier 4 standards, both in terms of the rule's compliance dates (which include a 2015 date for the final Tier 4 standards, one year later than we proposed) and the ABT and equipment manufacturer flexibilities. This lead time takes into account the long design periods, high cost, and low sales volumes of these engines. Thus, although we strongly disagree with the option of not adopting Tier 4 standards for these engines, we do recognize their need for unique standards and compliance dates.

Option 4 included applying the 15 ppm sulfur limit to both locomotive and marine diesel fuel in addition to nonroad fuel. On the basis of comments received and additional analyses, we have determined that a 15ppm sulfur standard for locomotive and marine fuel is appropriate, though we have included certain options for utilization of off-specification fuel and transmix not represented in our original Option 4. This aspect of our final program is discussed in detail in section IV.

Options 5a and 5b were identical to the proposed program except with respect to standards for engines less than 75 hp. Option 5a was identical to the proposed program except that no new program requirements would be set in Tier 4 for engines under 75 hp. Instead, Tier 2 standards and testing requirements for engines under 50 hp, and Tier 3 standards and testing requirements for 50-75 hp engines, would continue indefinitely. The Option 5b program was identical to the proposed program except that for engines under 75 hp only the 2008 engine standards would be set, i.e. there would be no additional PM filter-based standard in 2013 for 25-75 hp engines, and no additional NO_X+NMHC standard in 2013 for 25-50 hp engines. We are not adopting Options 5a or 5b in today's action. As explained at 8. 2.3 of the Summary and Analysis of Comments, and in sections 12.6.2.2.9 and 12.6.2.2.10 of chapter 12 of the draft RIA, these options would forego substantial PM and NO_X + NMHC emission reductions (on the order of hundreds of thousands of tons of each pollutant) which are feasible at reasonable cost. We note further that many of these smaller engines operate in populated areas and in equipment without closed cabs – in mowers, small construction machines, and the like – where personal exposures to toxic emissions (both

PM and air toxics which are part of the NMHC fraction) may be pronounced well beyond what is indicated simply by a comparison of nationwide emissions inventory estimates. We would also emphasize the remarkable growth in recent sales and usage for these smaller diesel machines, and we expect this trend to continue, pointing up the need for effective PM emissions control from these engines. We thus do not see a basis in law or policy to adopt either of these options.

In response to comments on our NPRM we also investigated a number of other variations in the engine standards as we developed our final rule. These variations were generally related to the phase-in of engine standards in a number of different horsepower categories. A discussion of these variations is provided in section II as well as in various background documents.

Table VII-1 contains a summary of a number of these alternatives. The expected emission reductions, costs, and monetized benefits associated with them in comparison to the proposed program were evaluated for the NPRM. Those analyses were not revised for this final rulemaking to reflect changes in our empirical models or assumptions. We received no new information that would cause us to believe that the relative impacts and differences for those alternative program options relative to our final program would change enough to make an impact on our assessments of the feasibility or appropriateness of the options. The remainder of this section will summarize some of the comments we received on the options and our responses to those comments.

Table VII-1. – Summary of Alternative Program Options

Option	Fuel Standards	Engine Standards [a]
Final program		
	•500 PPM in 2007 for NR, loco/marine •15 ppm in 2010 for NR •15 ppm in 2012 for loco/marine	•<75 hp: PM standards in 2008 •25-75 hp: PM AT-based standards in 2013 •75-175 hp: PM AT-based standards in 2012 •175-750 hp: PM AT-based standards in 2011 •75-175 hp: NO_X AT-based standards phase-in 2012-2014 •175-750 hp: NO_X AT-based standards phase-in 2011-2014 •>750 hp: PM and NO_X AT phased-in 2011 and 2015
1-Step Fuel Options		
1	•15 ppm in 2008 for NR and loco/marine	•< 50 hp: PM stds only in 2009 •25-75 hp: PM AT stds and EGR or equivalent NO_X technology in 2013; no NO_X AT •>75 hp: PM AT stds phasing in beginning in 2009; NO_X AT phasing in beginning in 2011
1a	•15 ppm in 2008 for NR, loco/marine	•PM AT introduced in 2009-10 •NO_X AT introduced in 2011-12
1b	•15 ppm in 2006 for NR, loco/marine	Same as 1a
2-Step Fuel Options		
2a	Same as proposed program except – •500 ppm in 2006 for NR, loco/marine	Same as proposed program
2b	Same as proposed program except – •15 ppm in 2009 for NR and loco/marine	Same as proposed program except – •Move PM AT up 1 year for all engines > 25 hp (phase in starts 2010)
2c	Same as proposed program except – •15 ppm in 2009 for NR and loco/marine	Same as proposed program except – •Move PM AT up 1 year for all engines 175-750 hp (phase in starts 2010)
2d	•Same as proposed program	Same as proposed program except – •Phase-in NO_X AT for 25-75hp beginning in 2013
Other Options		
3	•Same as proposed program	Same as proposed program except – •Mining equipment over 750 hp left at Tier 2
4	Same as proposed program except – •Downgrade flexibilities for loco/marine not included	Same as proposed program
5a	•Same as proposed program	Same as proposed program except- •No Tier 4 standards <75 hp
5b	•Same as proposed program	Same as proposed program except- •No new <75hp standards after 2008 (i.e., no CDPFs in 2013)

Notes: [a] AT = aftertreatment

B. Introduction of 15 ppm Nonroad Diesel Sulfur Fuel in One Step

EPA carefully evaluated an alternative which would require that the nonroad diesel sulfur level be reduced to 15ppm in a single step, beginning June 1, 2008. The one-step fuel options, including the three variations Option 1, Option 1a, and Option 1b, were presented and discussed in detail in the NPRM and in the draft RIA.

Many comments were received about a one step diesel fuel sulfur control approach taking effect in 2008. Refiners commented that they did not think that they could reduce both the highway and nonroad diesel fuel pools down to 15 ppm in the same timeframe while maintaining the supply of these two diesel fuel pools. The refiners went on to say that having a 500 ppm outlet for off-specification material in the nonroad diesel fuel pool is critical in the years after reducing the highway diesel fuel pool to 15 ppm to ensure supply of highway fuel. The refining industry further commented that the one step program would provide fewer environmental benefits and also provide the refining industry less time and flexibility to make the transition to the 15 ppm sulfur level for nonroad diesel fuel compared to a two step approach. While many environmental organizations and the Engine Manufacturers Association (EMA) commented that they preferred a 15 ppm standard as soon as possible, EMA also pointed out that a quick transition to 500 ppm would provide important fleet-wide emission reductions, reduce maintenance costs and enable the use of certain emission control technology such as exhaust gas recirculation and oxidation catalysts. Commenters generally said little about the engine standards associated with the one-step options, other than to point out that earlier introduction of 15 ppm sulfur fuel means that aftertreatment-based standards and nonroad engine retrofits can also be introduced earlier.

The reasons provided in the NPRM for choosing the two step program over the one-step program still apply and generally address the comments received (see section 12.6.2 of the draft RIA). Although there would be greater PM and NO_X emission reductions with the one-step approach due to earlier introduction of aftertreatment technology enabled by the 15 ppm sulfur diesel fuel, the SO_2 emission benefits for the two-step approach are greater due to the earlier adoption of the 500 ppm sulfur standard. Thus, even assuming that the one-step approach would not jeopardize implementation of the highway diesel emission rule, the emission impacts of these two options are mixed. Moreover, the costs for achieving the second step (15 ppm) of the two step approach are likely to be lower than under the one step approach. This is because advanced desulfurization technologies are much more likely to be used in 2010 after additional testing and demonstration, while they may hardly be considered at all if they would have to be installed for 2008. One advanced desulfurization technology, Process Dynamics Isotherming, is expected to lower the cost of complying with the 15 ppm step by about one cent per gallon. This cost discrepancy is expected to persist since it is associated with the investment of significant capital which cannot be modified or replaced without significant additional expense. Additionally, under the two step program, refiners will be able to use their experience in complying with 15 ppm highway diesel fuel sulfur standard to better design their nonroad hydrotreaters needed for 2010.

After careful consideration of these matters, we have decided to finalize the two-step approach in today's action.

C. Applying the 15 ppm Sulfur Cap to Locomotive and Marine Diesel Fuel

In the NPRM, we requested comment on extending the 15 ppm cap to locomotive and marine diesel fuel in 2010 or some later year as part of this rule. The costs and inventory impacts of this alternative were explored in the context of Option 4 in the NPRM. A 15ppm sulfur cap for

locomotive and marine fuel would increase the long-term PM and SO_2 benefits of the rule and would reduce the number of fuels being carried in the distribution system after 2014, when the small refiner provisions of this rule expire. It would also allow refiners to plan to comply with the 15 ppm cap for locomotive and marine diesel fuel at the same time as they plan to comply with the 500 ppm cap for NRLM fuel and the 15 ppm cap for nonroad fuel.

As a result of comments received and additional analyses performed since the NPRM, we are finalizing a 15 ppm sulfur cap for locomotive and marine fuel in today's notice. A full discussion of the feasibility and benefits of a 15 ppm sulfur cap for locomotive and marine fuel can be found in section IV, along with a summary of the comments we received and our responses to those comments. In addition, we are planning a separate rule to implement new emission standards for locomotive and marine diesel engines that will build upon the 15 ppm sulfur standard applicable to fuel used by these engines. We are publishing an Advanced Notice of Proposed Rulemaking in another section of today's Federal Register describing our plans in this area.

D. Other Alternatives

We also analyzed a number of other alternatives in the NPRM, as summarized in table VII-1. Some of these focused on control options more stringent than our final program while others reflect modified engine requirements that result in less stringent control. In the NPRM we presented our assessment of these options in terms of the feasibility, emission reductions, costs, and other relevant factors. Few comments were received on these other alternatives, and no new information arose to alter what we believe are significant concerns with respect to these Options compared to the final program. Hence, with the exception of the few alternative program elements that we did incorporate into our final program as described earlier in this section, we did not include these options into our final program. Our detailed responses to all the comments received on the other alternatives can be found in section 8 of the Summary and Analysis of Comments document.

VIII. Future Plans

The above discussion describes the contents of this final rule. This section addresses a variety of areas not addressed by this rule. In these several areas, we expect to continue our efforts to improve our compliance programs and achieve further reductions in emissions from nonroad engines.

A. Technology Review

As we described in sections III.E and G of the proposal, there are some technology issues that warrant our planning a future review of emissions control technology for engines under 75 hp. Under our implementation schedule presented in section II.A, standards based on the use of PM filter technology will take effect in the 2013 model year for 25–75 hp engines (or in the 2012 model year for manufacturers opting to skip the transitional standards for 50–75 hp engines). However, at this time we have not decided what long-term PM standards for engines under 25 hp are appropriate. No PM filter-based standards are being adopted for these under 25 hp engines in this final rule. Likewise, we have not decided what the long-term NO_X standards for engines under 75 hp should be, and no NO_X adsorber-based standards are being set for these engines in this final rule. As part of the technology review, we plan to thoroughly evaluate progress made toward applying advanced PM and NO_X control technologies to these smaller engines.

We plan to conduct the technology review in 2007, and to conclude it by the end of that year, to give manufacturers lead time should an adjustment in the program be considered appropriate. We do not intend to include in the technology review a reassessment of PM filter technology needed to meet the optional 0.02 g/hp-hr PM standard for 50–75 hp engines in 2012. We assume that manufacturers would only choose this option if they had confidence that they could meet the 0.02 g/hp-hr standard in 2012, a year earlier than otherwise required.

Numerous commenters expressed support for the planned technology review. MECA and STAPPA/ALAPCO stressed that the review should not be limited to considering the need to relax PM filter-based standards for small engines, but should also consider technology innovations that would justify increasing the stringency of small engine standards that are not currently aftertreatment-based. This is indeed our intent. Yanmar suggested that the review be deferred to 2010 or later, because NO_X control experience from highway diesels will not be sufficient by 2007. On the contrary, based on the rate of technology development progress to date for highway engines, we believe that there will be a very large amount of pertinent new information available by 2007, even though widespread field experience may be lacking. Waiting longer to conduct the technology review would, we believe, provide insufficient leadtime to the industry should an adjustment to the 2013 standards be found appropriate. Some engine and equipment manufacturers called for expanding the technology review to other power categories. As discussed in the proposal, we do not believe that a generalized technology review of the sort being conducted for the heavy-duty highway engine program is warranted, primarily due to the very fact

that the nonroad standards are modeled on the highway program, and the highway program does include this comprehensive review. We also do not see the specific technical issues for engines above 75 hp that have been identified for smaller engines, such as might warrant our expanding the review at this time. Engine manufacturers also expressed interest in a consultative process in the near future that would establish the scope, outputs, and criteria for the review, possibly including assigning responsibility for the review to an independent entity. Although we plan and hope to have the active participation of all interested parties in the review process, assigning responsibility for the review to groups or individuals outside the Agency would be inappropriate. As the review would be closely tied to potential subsequent rulemaking action by the Agency, it is essential that it adequately cover the relevant issues. To ensure this, it is imperative that we retain overall responsibility for the review. We have not yet worked out process details for the review, but will do so at some later date.

Several commenters strongly stressed the need for EPA to work with governmental standards-setting bodies in other countries to harmonize future standards. As discussed in section II.A.8, we recognize the importance of harmonizing nonroad diesel standards and have worked diligently with our colleagues responsible for setting such standards outside the U.S., thus far with good success. The March 2004 Directive that sets future nonroad diesel standards in the European Union (EU) will very closely align the EU program with our program in the Tier 4 timeframe.[251] Further enhancing prospects for close harmonization, the Directive includes plans for a future technical review: "There are still some uncertainties regarding the cost effectiveness of using after-treatment equipment to reduce emissions of particulate matter (PM) and of oxides of nitrogen (NO_X). A technical review should be carried out before 31 December 2007 and, where appropriate, exemptions or delayed entry into force dates should be considered."

Note that the timing for this review coincides with that of our own planned review. Among other things, both our review and the EU review will consider the appropriate long-term standards for engines between 25 and 50 hp, engines for which we have set PM-filter based standards and for which the EU has not. Furthermore, in addition to re-evaluating the standards, the EU technical review will consider the need to introduce standards for engines below 25 hp and above 750 hp, the two categories for which the EU has not yet set emission standards, and for which harmonization is thus most lacking. We are greatly encouraged by the degree of harmonization achieved thus far, and, given our common interests, issues and planned timing, expect to work closely with Commission staff in carrying out the 2007 technology review, with an aim of preserving and enhancing harmonization of standards.

In response to comments received on the proposal, we wish to clarify that the technology review for engines under 75 hp will be a comprehensive undertaking that may result in adjustments to standards, implementation dates, or other provisions (such as flexibilities) in either direction (that is, toward more or less stringency), depending on conclusions reached in the

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[251] Council of the European Union, "Directive of the European Parliament and of the Council amending Directive 97/68/EC," March 15, 2004.

review about appropriate standards under the Clean Air Act. All relevant factors including technical feasibility and commercial viability of engines and machines designed to meet the standards will be taken into account.

B. Test Procedure Issues

Section III describes two issues related to test procedures that warrant further attention in the future. First, we are adopting transient test procedures for engines subject to Tier 4 emission standards, but we intend to collect data that would help us adopt a duty cycle that would appropriately test constant-speed engines. Second, we are adopting cold-start test procedures, but are interested in collecting additional data that could be used to revise those procedures if appropriate.

C. In-use Testing

Although this final rule does not include an in-use testing program for nonroad diesel engines, we expect to establish such a program for the future in a separate rulemaking action. The goal of this program will be to ensure that emissions standards are met throughout the useful life of the engines, under conditions normally experienced in-use**.** The Agency expects to pattern the in-use testing requirements for nonroad diesel engines after a program that is being developed for heavy-duty diesel highway vehicles. This program will be funded and conducted by the manufacturer's of heavy-duty diesel highway engines with our oversight. We expect it will incorporate a two-year pilot program. The pilot program will allow the Agency and manufacturers to gain the necessary experience with the in-use testing protocols and generation of in-use test data using portable emission measurement devices prior to fully implementing program. A similar pilot program is expected to be part of any manufacturer-run, in-use NTE test program for nonroad engines.

The Agency plans to promulgate the in-use testing requirements for heavy-duty highway vehicles in the December 2004 time frame. We anticipate proposing a manufacturer-run, in-use testing program for nonroad diesel engines by 2005 or earlier. As mentioned above, the nonroad diesel engine program is expected to be patterned after the heavy-duty highway program.

D. Engine Diagnostics

We are also in the process of defining diagnostic requirements that would apply to highway diesel engines. Once we have adopted requirements for highway engines, we would aim to adapt the requirements as needed to appropriately address diagnostic needs for nonroad diesel engines. These programs would likely be very similar, but the diagnostics for nonroad engines my need to differ in some ways, depending on the technologies used by different types and sizes of engines and on an assessment of an appropriate level of information and control for engines used in nonroad applications.

E. Future NO_X Standards for Engines in Mobile Machinery Over 750 hp

In section II.A.4, we explain that we are not, at this time, setting Tier 4 NO_X standards for mobile machinery over 750 hp based on the performance of high-efficiency aftertreatment, although we note that the 2.6 g/bhp-hr NO_X standard taking effect for these engines in 2011 represents a more than 60% NO_X reduction from the 6.9 g/bhp-hr Tier 1 level in effect today, and a more than 40% reduction from the 4.8 g/bhp-hr NO_X+NMHC Tier 2 standard level that takes effect in 2006. We are still evaluating the issues involved for these engines to achieve a more stringent NO_X standard, and believe that these issues are resolvable. We intend to continue evaluating the appropriate long-term NO_X standard for mobile machinery over 750 hp and expect to announce further plans regarding these issues, perhaps as early as 2007.

F. Emission Standards for Locomotive and Marine Diesel Engines

This final rule adopts limited requirements to limit sulfur levels in distillate fuels used in locomotive and many marine diesel engines, which will help reduce PM emissions from these engines. In an upcoming rulemaking, we will consider an additional tier of NO_X and PM standards for marine diesel engines less than 30 liters per cylinder and for locomotive engines. These standards would reflect the application of advanced emission-control technology, including the potential to use the high-efficiency catalytic emission-control devices like those described elsewhere in this preamble. In developing these new standards, we will consider the substantial overlap in engine technology between the locomotive and marine engines and the nonroad engines covered by this final rule. We will also take into account the unique features associated with locomotive and marine engines (and their respective markets) and the extent to which these differences may constrain the feasibility of applying advanced emission control technologies to those engines.

We are concurrently publishing an Advance Notice of Proposed Rulemaking that describes the emission-control program we are contemplating for these engines. After consideration of comments submitted on the Advance Notice, we will publish a Notice of Proposed Rulemaking. Our proposal will be subject to comment before its expected completion in the 2006 time frame.

The engine emission control program to be described in the Advance Notice will cover all locomotive engines subject to 40 CFR part 92 and all marine diesel engines with displacement below 30 liters per cylinder. Note that the rule will therefore cover marine diesel engines below 37 kW, which are currently regulated through Tier 3 with land-based nonroad engines in 40 CFR part 89. The rule will also address both recreational and commercial marine diesel engines with displacement below 30 liters per cylinder. Marine engines at or above 30 liters per cylinder typically use a different kind of fuel, residual fuel, and will be considered in a separate rulemaking to be finalized by April 27, 2007, pursuant to a regulatory provision adopted in our recent rule setting standards for those engines (68 FR 9783, February 28, 2003).

G. Retrofit Programs

In the proposal, we requested comment on setting voluntary new engine emission standards applicable to the retrofit of nonroad diesel engines. As described in section III.A, we are not adopting a retrofit credit program with today's action. We believe it is important to more fully consider the details of a retrofit credit program and work with interested parties in determining whether a viable program can be developed. EPA intends to explore the possibility of a voluntary nonroad retrofit credit program through future action.

H. Reassess the Marker Specified for Heating Oil

As discussed in sections IV and V, we are requiring that the chemical marker solvent yellow 124 (SY-124) be added to heating oil outside of the Northeast/Mid-Atlantic Area. We received comments from the American Society of Testing and Materials (ASTM), the Coordinating Research Council (CRC), the Department of Defense (DoD), and the Federal Aviation Administration (FAA) requesting that we delay finalizing the selection of a specific marker for use in this final rule due to concerns for jet fuel contamination. ASTM withdrew its request for a postponement in the regulation, given that this final rule requires addition of the marker at the terminal, rather than the refinery gate as proposed. This eliminates most of the concern regarding jet fuel contamination. However, ASTM stated that some concern remains regarding jet fuel contamination downstream of the terminal. Nevertheless, ASTM related that these concerns need not delay finalization of the marker requirements in this rule, since a CRC program to evaluate these concerns is expected to be completed well before SY-124 must be added to heating oil. FAA is also undertaking an effort to identify fuel markers that would be compatible for use in jet fuel.

We also received comments from the heating oil industry and the Department of Defense, which expressed concerns regarding the potential health effects and maintenance impacts on heating oil equipment from the use of SY-124 in heating oil. As discussed in section V, we believe these concerns have been adequately addressed for us to specify the use of SY-124 in this final rule. The EU has required the use of SY-124 in heating oil since August 2002. The EU intends to re-evaluate the use of SY-124 after December 2005 or earlier if they learn of any health, safety, or environmental concerns from their in-use experience with SY-124.

We will keep abreast of the ASTM, CRC, FAA, IRS, and EU activities and commit to a review of our use of SY-124 under today's rule based on these findings. If alternative markers are identified that do not raise concerns regarding the potential contamination of jet fuel, we will initiate a rulemaking to evaluate the use of one of these markers in place of SY-124.

IX. Public Participation

Many interested parties provided their input on the proposed rulemaking during our public comment period. This comment period, along with the three public hearings that were held in New York, Chicago, and Los Angeles, provided ample opportunity for public participation. Throughout the rulemaking process, EPA met with stakeholders including representatives from the fuel refining and distribution industry, engine and equipment manufacturing industries, emission control manufacturing industry, environmental organizations, states, agricultural interests, and others.

A detailed Response to Comments document was prepared for this rulemaking that describes the comments that we received on the proposal along with our response to each of these comments. The Response to Comments document is available in the air docket and e-docket for this rule, as well as on the Office of Transportation and Air Quality homepage. In addition, comments and responses for many key issues are included throughout this preamble.

X. Statutory and Executive Order Reviews

A. Executive Order 12866: Regulatory Planning and Review

Under Executive Order 12866 (58 FR 51735, October 4, 1993), the Agency must determine whether the regulatory action is "significant" and therefore subject to review by the Office of Management and Budget (OMB) and the requirements of this Executive Order. The Executive Order defines a "significant regulatory action" as any regulatory action that is likely to result in a rule that may –

- Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, Local, or Tribal governments or communities;
- Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;
- Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs, or the rights and obligations of recipients thereof; or
- Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

A final Regulatory Impact Analysis has been prepared and is available in the docket for this rulemaking and at the internet address listed under **"How Can I Get Copies of This Document and Other Related Information?"** above. This action was submitted to the Office of Management and Budget for review under Executive Order 12866. Estimated annual costs of this rulemaking are estimated to be $2 billion per year, thus this proposed rule is considered economically significant. Written comments from OMB and responses from EPA to OMB comments are in the public docket for this rulemaking.

B. Paperwork Reduction Act

The information collection requirements in this 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*. The information collection requirements are not enforceable until OMB approves them. The OMB control number for engine-related information collection is 2060-0460 (EPA ICR number 1897.07) and for fuel-related information collection is 2060-0308 (EPA ICR number 1718.07).

We will use the engine-related information to ensure that new nonroad diesel engines comply with emission standards through certification requirements and various subsequent compliance provisions. This information collection is mandatory under the provisions of 42 U.S.C. 7401 - 7671(q). We will use the fuel-related information to ensure that diesel fuel meets the sulfur limits and corresponding requirements related to marking and segregating the different

types and grades of diesel fuel. This information collection is mandatory under the provisions of 42 U.S.C. 7545(c), (g) and (i), and 7625-1.

In addition, this notice announces OMB's approval of the information collection requirements for other programs, as summarized in Table X.B-1.

Table X.B-1 – Approved Information Collection Requests from Other Programs

Program	Final Rule Cite	OMB Control Number	EPA ICR Number	OMB Approval
Nonroad spark-ignition engines over 19 kW	November 8, 2002 (67 FR 68242)	2060-0460	1897.04	January 31, 2003
Recreational vehicles	November 8, 2002 (67 FR 68242)	2060-0460	1897.04	January 31, 2003
Rebuilders of various types of engines	November 8, 2002 (67 FR 68242)	2060-0104	0783.46	June 11, 2003
Highway motorcycles	January 15, 2004 (69 FR 2398)	2060-0104	0783.46	March 26, 2004

The estimated annual public reporting and recordkeeping burden for collecting information from all these programs is shown in Table X.B-2. 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.

Table X.B-2. – Information Collection Burdens

Engine Type	Respondents	Hours per Respondent	Hours for All Respondents	Capital Costs for All Respondents	Operating and Maintenance Costs for All Respondents	Total Costs for All Respondents
Nonroad diesel engine manufacturers	75	3,304	247,783	$0	$5,894,802	$18,661,614
Diesel Fuel Suppliers	2,615	75	196,288	$1,800,000	$1,800,000	$18,371,600
Nonroad spark-ignition engine manufacturers	12	1,832	21,986	$174,419	$2,507,790	$3,617,683
Recreational vehicle manufacturers	39	684	26,669	$1,627,907	$2,137,115	$4,869,253
Highway Motorcycles	46	32	1,449	$0	$23,686	$79,428
Importers	40	13	529	$0	$150,000	$169,223
Rebuilders	200	6	1,200	$0	$0	$38,800

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, the Agency 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. EPA received various comments on the rulemaking provisions covered by the ICRs, but no comments on the paperwork burden or other information in the ICRs. All comments that were submitted to EPA are considered in the relevant Summary and Analysis of Comments, which can be found in the docket. A copy of any of the submitted ICR documents may be obtained from Susan Auby, Collection Strategies Division, U.S. Environmental Protection Agency (2822-T), 1200 Pennsylvania Ave., NW, Washington, DC 20460 or by email at auby.susan@epa.gov.

To comment on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including the use of automated collection techniques, EPA has a public docket for this rule, which includes this ICR, under Docket ID number OAR-2003-0012. Submit any comments related to the ICR for this rule to EPA and OMB. Address comments to OMB by email to drostker@omb.eop.gov or fax to (202) 395-7285. Please do not send comments to OMB via U.S. Mail.

C. Regulatory Flexibility Act (RFA), as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), 5 USC 601 et. seq

EPA has decided to prepare a Regulatory Flexibility Analysis (RFA) in connection with this final rule. For purposes of assessing the impacts of today's rule on small entities, a small entity is defined as: (1) a small business that is primarily engaged in the manufacturing of nonroad diesel engines and equipment that meets the definitions based on the Small Business Administration's (SBA) size standards (see table X.C.-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 X.C-1. – Small Business Administration Size Standards for Various Business Categories

Industry	Defined as small entity by SBA if:	Major SIC[a] Codes
Engine manufacturers	Less than 1,000 employees	Major Group 35
Equipment manufacturers:		
- construction equipment	Less than 750 employees	Major Group 35
- industrial truck manufacturers (i.e. forklifts)	Less than 750 employees	Major Group 35
- all other nonroad equipment manufacturers	Less than 500 employees	Major Group 35
Fuel refiners	Less than 1500 employees[b]	2911
Fuel distributors	<varies>	<varies>

Notes:

[a] Standard Industrial Classification

[b] EPA has included in past fuels rulemakings a provision that, in order to qualify for the small refiner flexibilities, a refiner must also have a company-wide crude refining capacity of no greater than 155,000 barrels per calendar day. EPA has included this criterion in the small refiner definition for a nonroad diesel sulfur program as well.

Pursuant to 5 U.S.C. section 603, EPA prepared an Initial Regulatory Flexibility Analysis (IRFA) for the proposed rule and convened a Small Business Advocacy Review Panel (SBAR Panel, or 'the Panel') to obtain advice and recommendations of representatives of the regulated small entities pursuant to 5 U.S.C. section 609(b) (see 68 FR 28518-28521, May 23, 2003). A detailed discussion of the Panel's advice and recommendations can be found in the Panel Report (Docket A-2001-28, Document No. II-A-172). See also section III.C above.

We have also prepared a Regulatory Flexibility Analysis for today's rule. The Regulatory Flexibility Analysis addresses the issues raised in public comments on the IRFA, which was part of the proposal of this rule. The Regulatory Flexibility Analysis is available for review in the docket and is summarized below. The key elements of a regulatory flexibility analysis include –

- The need for, and objectives of, the rule;
- The significant issues raised by public comments, a summary of the Agency's assessment of those issues, and a statement of any changes made to the proposed rule as a result of those comments;
- The types and number of small entities to which the rule will apply;
- The reporting, record keeping and other compliance requirements of the rule; and
- The steps taken to minimize the impact of the rule on small entities, consistent with the stated objectives of the applicable statute.

1. Need For and Objectives of the Rule

Controlling emissions from nonroad engines and equipment, in conjunction with controls on sulfur concentrations in diesel fuel, has very significant public health and welfare benefits, as explained in section I of this preamble. We are finalizing new engine standards and related provisions under sections 213(a)(3) and (4) of the Clean Air Act which, among other things, direct us to establish (and from time to time revise) emission standards for new nonroad diesel engines. Similarly, section 211(c)(1) authorizes EPA to regulate fuels if any emission product of the fuel causes or contributes to air pollution that may endanger public health or welfare, or that may impair the performance of emission control technology on engines and vehicles. We are finalizing new fuel standards today for both of these reasons.

2. Summary of Significant Public Comments on the IRFA

We received comments from engine and equipment manufacturers, fuel refiners, fuel distributors and marketers, and consumers during the public comment period following the proposal of this rulemaking. All of the following comments were taken into account in developing today's final rule. Responses to these comments are located in subsection 5 below, along with the description of the provisions that we are finalizing to reduce the rule's impact on small businesses. More detailed information in response to these comments can be found in sections III.C. (Engine and Equipment Small Business Provisions) and IV.B (Hardship Relief Provisions for Qualifying Refiners) of this preamble. Additional detail may also be found in the Final Regulatory Flexibility Analysis, located in the Regulatory Impact Analysis, as well as in the Summary and Analysis of Comments for this final rule.

a. Public Comments Received on Engine and Equipment Standards

One small engine manufacturer commented that the proposed provisions for small business engine manufacturers are appropriate and strongly supported their inclusion in the final

rule. The manufacturer raised many concerns of why it believes that it is necessary to include provisions, such as: larger/higher-volume manufacturers will have priority in supply of new technologies and will have more R&D time to complete development of these systems before they are available to smaller manufacturers; smaller manufacturers do not command the same amount of attention from potential suppliers of critical technologies for Tier 4 controls, and are thus concerned that they may not be able to attract a manufacturer to work with them on the development of compliant technologies. This small manufacturer believes that the additional three-year time period proposed for small engine manufacturers in the NPRM is necessary for the company, and is their estimate of the time that it will take for these technologies to be available to small engine manufacturers.

The Small Business Administration's Office of Advocacy ("Advocacy") raised the concern that the rule would impose significant burdens on a substantial number of small entities producing engines of 75 hp or less, with little corresponding environmental benefit. Advocacy therefore recommended that PM standards for engines in the 25-75 hp range not be based on performance of aftertreatment technologies. Advocacy believed that the proposed flexibilities will not suffice on their own to appropriately minimize the regulatory burdens on small entities; and Advocacy noted that during the SBREFA process some small equipment manufacturers stated that although EPA would allow some equipment to be sold which would not require new emissions controls, engine manufacturers would not produce or sell such equipment. Advocacy also commented that we have not shown that substantial numbers of small businesses have taken advantage of previous small business flexibilities, or that small businesses would be able to take advantage of the flexibilities under this rule. Lastly, Advocacy commented that although full compliance with the more stringent emissions controls requirements would be delayed for small manufacturers, small business manufacturers eventually will be required to produce equipment meeting the new requirements.

b. Public Comments Received on Fuel Standards

i. General Comments on Small Refiner Flexibility

One small refiner commented that it is not feasible at this time to evaluate the impact of the three fuels regulations on the refining industry (and small refiners), however it stated that we should continue to evaluate the impacts and act quickly to avoid shortages and price spikes and we should be prepared, if necessary, to act quickly in considering changes in the regulations to avoid these problems. We also received comment that some small refiners that produce locomotive and marine fuels fear that future sulfur reductions to these markets could be very damaging.

ii. Comments on the Small Refiner Definition

A small refiner commented that the proposed redefinition of a small refiner (to not grandfather as small refiners those that were small for highway diesel) would both negate the

benefits afforded under the small refiner provisions in the Highway Diesel Sulfur rule and disqualify its status as a small refiner. The small refiner is, however, in support of the addition of the capacity limit in the small refiner definition which will correct the problem of the inadvertent loop-hole in the two previous fuel rules. Though the refiner is concerned that the wording of the proposed language may result in small refiners such as itself, who grew by normal business practice, being disqualified as small refiners. The refiner suggested that we clarify the language and include provisions for continuance of small refiner flexibility for refiners who qualified under the Highway Diesel Sulfur rule (and have not been disqualified as the result of a merger or acquisition).

iii. Comments on the Baseline Approach

A coalition of small refiners provided comments on a few aspects of concern. The small refiners believe that the fuel segregation, and ensuing marking and dying, provisions are quite complex. One small refiner believes that mandating a minimum volume of NRLM production would conflict with the purpose of maintaining adequate on-highway volumes of 15ppm sulfur fuel and unnecessarily restricts small refiners, and offered suggestions in their comments on how to improve the language. In addition, the small refiner believes that mandating a minimum volume of NRLM production would conflict with the purpose of maintaining adequate on-highway volumes of 15ppm sulfur fuel and unnecessarily restricts small refiners, and offered suggestions in their comments on how to improve the language.

iv. Comments on Small Refiner 'Option 4'

A coalition of small refiners commented that if the final rule is not issued before January 1, 2004, a provision should be made to accommodate those small refiners planning to take advantage of the proposed small refiner "Option 4" (the NRLM/Gasoline Compliance option). A small refiner echoed the concerns of the small refiner coalition, commenting that delayed finalization of the final rule would undermine the benefits of small refiner flexibility Option 4. The small refiner is concerned that a delay in issuing the rule, and subsequent delay in the opportunity to apply the interim gasoline flexibility, would negate its opportunity to take full advantage of the credits the refiner now has, as it would not be able to comply with the 300 ppm cap. The small refiner suggested that we allow small refiners to apply for temporary relief and operate under the Option 4 provision. Another small refiner commented that, in the NPRM, it was unclear if a small refiner could elect to use any or all of the first three of the small refiner provisions if it did not elect to use Option 4. Further, the refiner understood that if Option 4 was chosen, a small refiner could not use any of the first three options. The refiner believes that it is important that a small refiner be able to use Options 1, 2, and 3 in combination with each other, and stated that we need to clarify the intent in the final rule. The small refiner also commented that the provisions in 40 CFR §§ 80.553 and 80.554 are not clear and should be revised to clarify their intent. Specifically, the refiner questioned whether or not a small refiner who committed to producing ULSD by June 1, 2006 in exchange for an extension of its interim gasoline sulfur

standards (under 40 CFR 80.553) could elect to exercise the options allowed under 40 CFR 80.554.

A small refiner raised the concern that the small refiner Option 4 only provides an adjustment to those small refiners whose small refiner gasoline sulfur standards were established through the hardship process of 40 CFR 80.240. The small refiner suggested that we finalize a compliance option that allows a 20 percent increase in small refiner gasoline sulfur standards be extended to all small refiners, not just those with standards established pursuant 40 CFR 80.240(a), and offers suggested language in its comments.

v. Comments on Emission Impacts of the Small Refiner Provisions

A state environmental group commented that the provisions for small refiners raise substantial environmental concerns. The group is concerned that these provisions will allow small refiners the ability to produce gasoline with an unknown sulfur content for an unknown length of time; this fuel may then be sold at the refiner's retail outlet, and may become the primary fuel for some vehicles, which alters vehicle fleet emissions performance. This environmental group also commented that the absence of any process of notification regarding small business provisions to notify States of these provisions is troubling. The concern is that these deviations from fuel content that affects fuels consumed in states that use emissions inventories for air quality planning purposes, and can significantly alter inventories. The group suggested that in the future there should be greater communication from us regarding decisions that impact the quality of fuels consumed in a state, and thus impact the quality of that state's air.

Another state environmental group commented on the flexibility provisions for small refiners; the group is concerned that the exemption will *not* have a minor effect on the nation's fuel supply, as the state is an intermountain western state. The group comments that the impact of this exemption is concentrated in these states, namely Washington and Oregon – states which are served primarily by refineries that will be allowed to delay compliance with the ULSD standards until 2014. Therefore, the group commented, residents of these areas are denied air quality benefits equivalent to those promised the rest of the country. Those seeking to purchase and use equipment in these areas will be subject to the ULSD standard regardless of fuel supply and availability in their area, would be faced with misfueling, deferring purchase of new equipment, or paying a premium for a "boutique" fuel.

vi. Comments on Inclusion of a Crude Capacity Limit for Small Refiners and Leadtime Afforded for Mergers and Acquisitions

A non-small refiner supported the inclusion of the 155,000 bpcd limit, but suggested that we limit the provision of affording a two-year leadtime to small refiners who lose their small status due to merger or acquisition to the case where a small refiner merges with another small refiner. Further, the refiner commented that it would be inappropriate to allow such small refiners to be able to generate credits for "early" production of lower sulfur diesels during this two-year

leadtime. Lastly, the refiner commented that a small refiner which acquires a non-small refiner, and thus loses its small refiner status, should not be eligible for hardship provisions. Another commenter stated that if we were to finalize the 155,000 bpcd limit, we should not apply it in cases of a merger between two small refiners. The commenter further stated that a merger of two small companies in a hardship condition does not imply improved financial health in the same way that an acquisition would. Another non-small refiner commented that it supports the two-year lead time for refineries that lose their status as a small refiner; the refiner believes that any refiner with the financial wherewithal to acquire additional refineries to allow its crude capacity to exceed 155,000 bpcd should not be able to retain status as a small refiner.

vii. Necessity of Small Refiner Program

A non-small refiner provided comment on the NPRM stating the belief that the proposed provisions for small refiners are not practical. The refiner is concerned that having provisions for small refiners adds a level of complication, results in emissions losses, increases the potential for ULSD contamination, and create an unfair situation in the marketplace. Similarly, another non-small refiner and a trade group representing many refiners and others in the fuels industry commented that they oppose the extension of compliance deadlines for small refiners, as this can result in inequitable situations that may affect the refining industry for some time and can put the distribution system at risk for contamination of lower sulfur fuels. They further stated that all refiners will face challenges in complying with the upcoming standards and would not significantly alter the business decisions that small refiners would make. They also stated that non-small refiners face similar issues with their older and/or smaller refineries, but will not have the benefit of being able to postpone making these decisions as small refiners will.

viii. Comments on Fuel Marker

We received comments from terminal operators stating that the proposed heating oil marker requirements would force small terminal operators to install expensive injection equipment and that they would not be able to recoup the costs.

3. Types and Number of Small Entities

The small entities directly regulated by this final rule are nonroad diesel engine and equipment manufacturers, nonroad diesel fuel refiners, and nonroad diesel fuel distributors and marketers. These categories are described in more detail below, and the definitions of small entities in those categories are listed in table X.C-1 above.

a. Nonroad Diesel Engine Manufacturers

Before beginning the SBREFA process, EPA conducted an industry profile for the nonroad diesel sector. We have not received any new information since that time and we continue to believe that this is a valid characterization of the industry. Using information from the industry

profile, EPA identified a total of 61 engine manufacturers. The top 10 engine manufacturers comprise 80 percent of the total market, while the other 51 companies make up the remaining 20 percent.[252] Of the 61 manufacturers, four fit the SBA definition of a small entity. These four manufacturers were Anadolu Motors, Farymann Diesel GMBH, Lister-Petter Group, and V & L Tools (parent company of Wisconsin Motors LLC, formerly "Wis-Con Total Power"). These businesses comprised eight percent of the total nonroad engine sales for the year 2000.

b. Nonroad Diesel Equipment Manufacturers

We also used the industry profile to determine the number of nonroad small business equipment manufacturers. EPA identified over 700 manufacturers with sales and/or employment data that could be included in the screening analysis. These businesses included manufacturers in the construction, agricultural, mining, and outdoor power equipment (mainly, lawn and garden equipment) sectors of the nonroad diesel market. The equipment produced by these manufacturers ranged from small walk-behind equipment (sub-25 hp engines) to large mining and construction equipment (using engines in excess of 750 hp). Of the manufacturers with available sales *and* employment data (approximately 500 manufacturers), nonroad small business equipment manufacturers represent 68 percent of total nonroad equipment manufacturers (and these manufacturers accounted for 11 percent of nonroad diesel equipment industry sales in 2000).

c. Nonroad Diesel Fuel Refiners

Our current assessment is that 26 refiners (collectively owning 33 refineries) meet SBA's definition of a small business for the refining industry. The 33 refineries appear to meet both the employee number and production volume criteria mentioned above. These small refiners currently produce approximately 6 percent of the total high-sulfur diesel fuel. It should be noted that because of the dynamics in the refining industry (e.g., mergers and acquisitions), the actual number of refiners that ultimately qualify for small refiner status under the nonroad diesel sulfur program could be different than this assessment.

d. Nonroad Diesel Fuel Distributors and Marketers

The industry that transports, distributes, and markets nonroad diesel fuel encompasses a wide range of businesses, including bulk terminals, bulk plants, fuel oil dealers, and diesel fuel trucking operations, and totals thousands of entities that have some role in this activity. Over 90 percent of these entities meet small entity criteria. Common carrier pipeline companies are also a part of the distribution system; 10 of them are small businesses.

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[252] All sales information used for this analysis was 2000 data.

4. Reporting, Recordkeeping and Other Compliance Requirements

This section describes the expected burden of the compliance requirements (for all manufacturers and refiners) for the standards being finalized in today's action.

a. Nonroad Diesel Engine and Equipment Manufacturers

For engine and equipment standards, we must have the assurance that engines and/or equipment produced by manufacturers meet the applicable standard, and will continue to meet this standard as the equipment passes through to the ultimate end user. We are continuing many of the reporting, recordkeeping, and compliance requirements prescribed for nonroad engines and equipment, as set out in 40 CFR part 89. These include, certification requirements and reporting of production, emissions information, use of transition provisions, etc. The types of professional skills required to prepare reports and records are also similar to the types of skills that were needed to meet the regulatory requirements set out in 40 CFR part 89. Key differences in the requirements of today's rule as related to 40 CFR part 89 are the additional testing and defect reporting. We are finalizing an increase in the number of data points (i.e., transient testing) that will be required for reporting emissions information. Also, as proposed, we are requiring additional defect reporting for Tier 4 and later engines. We are requiring that manufacturers report to us if they learn that a substantial number of their engines have emission-related defects. This is generally not a requirement to collect information; however if manufacturers learn that there are or might be a substantial number of emission-related defects, then they must send us information describing the defects.

b. Nonroad Diesel Fuel Refiners, Distributors, and Marketers

For any fuel control program, we must have the assurance that fuel produced by refiners meets the applicable standard, and that the fuel continues to meet this standard as it passes downstream through the distribution system to the ultimate end user. This is particularly important in the case of diesel fuel, where the aftertreatment technologies expected to be used to meet the engine standards are highly sensitive to sulfur. Many of the recordkeeping, reporting and compliance provisions of the today's action are fairly consistent with those in place today for other fuel programs, including the current 15 ppm highway diesel regulation. For example, recordkeeping involves the use of product transfer documents, which are already required under the 15 ppm highway diesel sulfur rule (40 CFR 80.560). Under today's final rule we are adding additional recordkeeping and reporting requirements for refiners, importers, and fuel distributors to implement the designate and track provisions. However, interactions with parties from all segments of the distribution system indicated that the records necessary were analogous to records already kept as a normal process of doing business. Consequently, the only significant additional burden would be associated with the reporting requirement.

General requirements for reporting for refiners and importers include: registration (only in the case where a refiner or importer is not registered under a previous fuel program), pre-

compliance reports (on a refiner or importer's progress towards meeting the nonroad diesel fuel requirements as specified in this rule), quarterly designation reports, and annual reports. All parties from the refiner to the terminal will be required to report volumes of designated fuels received and distributed, as well as compliance with quarterly and annual limits. All parties in the distribution system are required to keep product transfer documents (PTDs), though refiners and importers are required to initially generate and provide information on commercial PTDs that identify the diesel fuel with meeting specific needs (i.e., 15 ppm highway diesel, 500 ppm highway diesel, etc.). Also, refiners in Alaska and small refiner/credit fuel users must report end users of their fuel. These end users must also keep records of these fuel purchases. Lastly, small refiners are required to apply for small refiner status and small refiner baselines.

In general, we are requiring that all records be kept for at least five years. This recordkeeping requirement should impose little additional burden, as five years is the applicable statute of limitations for current fuel programs.

See section X.B, above, for a discussion of the estimated burden hours and costs of the recordkeeping and reporting that will be required by this final rule. Detailed information on the reporting and recordkeeping measures associated with this rulemaking are described in the Information Collection Requests (ICRs) for this rulemaking – 1897.05 for nonroad diesel engines, and 1718.05 for fuel-related items.

5. Regulatory Alternatives To Minimize Impact on Small Entities

Below we discuss the Panel recommendations, EPA proposals, and final regulatory alternatives to minimize the rule's impact on small entities. More detailed information on the provisions for these entities can be found in sections III.C and IV.B of this preamble (for small business engine and equipment manufacturers and small entities throughout the fuel distribution system, respectively).

a. Panel Recommendations

During the SBREFA process, the Panel recommended transition flexibilities that we considered during the development of the NPRM. The Panel recommended provisions for both the one-step and two-step options. Since we are finalizing a two-step approach, only the recommendations for this approach are being discussed here. (A complete discussion of all of the Panel recommendations and our proposals for small entities is located in section X.C. of the NPRM.)

Following the SBREFA process, the Panel (or some Panel members), recommended the following transition flexibilities and hardship provisions to help mitigate the impacts of the rulemaking on small entities. We proposed and requested comment on these recommendations in the NPRM.

i. Panel Recommendations for Small Business Engine Manufacturers

For nonroad diesel small business engine manufacturers, we proposed the following provisions:

- a manufacturer must have certified in model year 2002 or earlier and would be limited to 2500 units per year to be eligible for all provisions set out below;
- for PM-
  - small engine manufacturers could delay compliance with the standards for up to three years for engines under 25 hp, and those between 75 and 175 hp (as these engines only have one standard)
  - small engine manufacturers have the option to delay compliance for one year if interim standards are met for engines between 50 and 75 hp (for this power category we are treating the PM standard as a two phase standard with the stipulation that small manufacturers cannot use PM credits to meet the interim standard; also, if a small manufacturer elects the optional approach to the standard (elects to skip the interim standard), no further relief will be provided)
- for NOx[253]-
  - a three year delay in the program for engines in the 25-50 hp and the 75-175 hp categories, consistent with the one-phase approach recommendation above;
- a small engine manufacturer could be afforded up to two years of hardship (in addition to the transition flexibilities) upon demonstrating to EPA a significant hardship situation;
- small engine manufacturers would be able to participate in an averaging, banking, and trading (ABT) program (which we proposed as part of the overall rulemaking program for all manufacturers);
- engines under 25 hp would not be subject to standards based on use of advanced aftertreatment; and,
- no NO_X aftertreatment-based standards for engines 75 hp and under.

ii. Panel Recommendations for Small Business Equipment Manufacturers

We proposed the following provisions for nonroad diesel small business equipment manufacturers:

- small business nonroad diesel equipment manufacturers must have reported equipment sales using certified engines in model year 2002 or earlier to be eligible for all provisions;

[253] There is no change in the NO_X standard for engines under 25 hp and those between 50 and 75 hp. For these two power bands EPA proposed no special provisions.

- essential continuance of the transition flexibilities offered for the Tier 1 and Tier 2 nonroad diesel emission standards (40 CFR 89.102), which are available to all nonroad diesel equipment manufacturers
  - ‘percent-of-production allowance’- over seven model-year period manufacturers may install engines not certified to the new emission standards in an amount of equipment equivalent to 80 percent of one year’s production, implemented by power category with the average determined over the period in which the flexibility is used (this proposal would afford additional flexibility over the comparable flexibility in Tier 2/3, however, because of the smaller number of horsepower categories in the Tier 4 rule)
  - ‘small volume allowance’- a manufacturer may exceed the 80 percent allowance in seven years as described above, provided that the previous Tier engine use does not exceed 700 total over seven years, and 200 in any given year, limited to one family per power category; alternatively, at the manufacturer’s choice by horsepower category, a program that eliminates the “single family provision” restriction with revised total and annual sales limits as shown below:

    ≤175 hp: 525 previous Tier engines (over 7 years) with an annual cap of 150 units (separate for each hp category)
    >175 hp: 350 previous Tier engines (over 7 years) with an annual cap of 100 units (separate for each hp category);
- small business equipment manufacturers would be allowed to borrow from the Tier 3/Tier 4 flexibilities for use in the Tier 2/Tier 3 time frame; and,
- small business equipment manufacturers could be afforded up to two years of hardship after other transition allowances are exhausted, similar to that offered small business engine manufacturers.

In addition, we proposed the Panel’s recommendation that the provisions for small equipment manufacturers be extended to all equipment manufacturers, regardless of size. We also sought comment on the total number of engines and annual cap values proposed and on implementing the small volume allowance provision without a limit on the number of engine families.

iii. Panel Recommendations for Small Refiners, Distributors, and Marketers

The following provisions were proposed for nonroad diesel small refiners:

- small refiners would be required to use 500 ppm sulfur fuel beginning June 1, 2010 and 15 ppm fuel beginning June 1, 2014;
- small refiners may choose one of the following transition provisions, which serve to encourage early compliance with the diesel fuel sulfur standards:

- Credits for Early Desulfurization: would allow small refiners to generate and sell credits for nonroad diesel fuel that meets the small refiner standards earlier than required in the regulation; or,
- Limited Relief on Small Refiner Interim Gasoline Sulfur Standards: a small refiner producing its entire nonroad diesel fuel pool at 15 ppm sulfur by June 1, 2006, and who chooses not to generate nonroad credits for early compliance, would receive a 20 percent relaxation in its assigned small refiner interim gasoline sulfur standards (with the maximum per-gallon sulfur cap for any small refiner remaining at 450 ppm); and,

• a small refiner would be afforded hardship similar to the provisions established under 40 CFR 80.270 and 80.560 (the gasoline sulfur and highway diesel fuel sulfur programs, respectively), case-by-case approval of hardship applications must be sought based on demonstration of extreme hardship circumstances.

We did not propose specific provisions for nonroad diesel fuel distributors and marketers in the NPRM. During the SBREFA process, distributors commented that they would support a one-step approach to eliminate the possibility of having multiple grades of fuel in the distribution system and the Panel recommended that we further study this issue during the development of the rule.

iv. Additional Panel Recommendations

Some, but not all, Panel members recommended that the following provisions be included in the NPRM; we requested comment on these items but did not propose them:

- the inclusion of a technological review of the standards in the 2008 time frame
- no PM aftertreatment-based standards for engines between 25 and 75 hp

b. Discussion of Items Being Finalized in Today's Action

i. Provisions for Small Business Engine Manufacturers

For nonroad diesel small business engine manufacturers, we are finalizing many of the provisions set out above with some significant revisions, as described below. We are finalizing all of the hardship provisions that we proposed. We believe these provisions are an element of providing appropriate lead time for this class of engines.

For engines under 25 hp:

- PM- a manufacturer may elect to delay compliance with the standard for up to three years.

- NOx- there is no change in the existing NO_X standard for engines in this category, so no special provisions are being provided.

For engines in the 25 to 50 hp category:

- PM- manufacturers must comply with the interim standards (the Tier 4 requirements that begin in model year 2008) on time, and may elect to delay compliance with the 2013 Tier 4 requirements (0.02 g/bhp-hr PM standard) for up to three years.
- NOx- a manufacturer may elect to delay compliance with the standard for up to three years.

For engines in the 50 to 75 hp category:

- PM- A small business engine manufacturer may delay compliance with the 2013 Tier 4 requirement of 0.02 g/bhp-hr PM for up to three years provided that it complies with the interim Tier 4 requirements that begin in model year 2008 on time, without the use of credits (as manufacturers of engines in this category still have the option to comply with the Tier 3 standard). Alternatively, a manufacturer may elect to skip the interim standard completely. Manufacturers choosing this option will receive only one additional year for compliance with the 0.02 g/bhp-hr standard (i.e. compliance in 2013, rather than 2012).
- NO_X- there is no change in the NO_X standard for engines in this category, therefore no special provisions are being provided.

For engines in the 75 to 175 hp category:

- PM- a manufacturer may elect to delay compliance with the standard for up to three years.
- NOx- a manufacturer may elect to delay compliance with the standard for up to three years.

In regard to the Office of Advocacy's concern regarding the technical feasibility of PM and NO_X aftertreatment devices, as proposed in the NPRM, we are not adopting standards based on performance of NO_X aftertreatment technologies for engines under 75 hp. We believe the factual record – as documented in the RIA, the Summary and Analysis of Comments, and this preamble – does not support the claim that the PM standards will not be technically feasible in 2013 for the 25-75 hp engines. As set out at length in section 4.1.3 of the RIA, among other places, performance of PM traps is not dependent on engine size.

We disagree with the statement made by the Office of Advocacy that, based on available information, we do not have a sufficient basis for engines between 25 and 75 hp to be subject to PM standards based on use of advanced aftertreatment. As we have documented earlier and in the

RIA, we believe that such standards are feasible for these engines at reasonable cost,[254] and will help to improve very important air quality problems, especially by reducing exposure to diesel PM and by aiding in attainment of the PM 2.5 National Ambient Air Quality Standard. See generally, comment response 8.2.3 of the Summary and Analysis of Comments, and sections 12.6.2.2.9 and 12.6.2.2.10 of chapter 12 of the Draft RIA. These standards will also result in significant reductions of NMHC, which includes many carcinogenic air toxics. Indeed, given these facts, we are skeptical that an alternative of no aftertreatment-based PM standards for these engines would be appropriate under section 213(a)(4) of the Clean Air Act (see section VII.A above, where we found that "[w]e ... do not see a basis in law or policy to adopt either of these options"). We believe that the transition and hardship provisions being finalized for small business engine manufacturers in today's action are reasonable and are a factor in our ultimate finding that the PM standards for engines in the 25–75 hp range are appropriate.

ii. Provisions for Small Business Equipment Manufacturers

The transition and hardship provisions that were proposed for small business nonroad equipment manufacturers are being finalized today, with some modifications.

Adopting an alternative on which we solicited comment, the final rule allows all equipment manufacturers the opportunity to choose between two options: a) manufacturers would be allowed to exempt 700 pieces of equipment over seven years, with one engine family; or b) manufacturers using the small-volume allowance could exempt 525 machines over seven years (with a maximum of 150 in any given year) for each of the three power categories below 175 horsepower, and 350 machines over seven years (with a maximum of 100 in any given year) for the two power categories above 175 horsepower. Concurrent with the revised caps, manufacturers could exempt engines from more than one engine family under the small-volume allowance program. Based on sales information for small businesses, we estimated that the alternative small-volume allowance program to include lower caps and allow manufacturers to exempt more than one engine family would keep the total number of engines eligible for the allowance at roughly the same overall level as the 700-unit program. We believe that these provisions will afford small manufacturers the type of transition leeway recommended by the Panel. Further, these transition provisions could allow small business equipment manufacturers to postpone any redesign needed on low sales volume or difficult equipment packages, thus saving both money and strain on limited engineering staffs. Within limits, small business equipment manufacturers would be able to continue to use their current engine/equipment configuration and avoid out-of-cycle equipment redesign until the allowances are exhausted or the time limit passes.

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[254] As the cost issues raised in SBA's comments relate to all manufacturers (not just small business manufacturers), further information on the costs of this technology as well as the benefits analysis, can be found in section VI of this preamble (and also chapters 6 and 9, respectively, of the Regulatory Impact Analysis).

We are not finalizing the requirement that small equipment manufacturers and importers have reported equipment sales using certified engines in model year 2002 or earlier. Please see section III.C.2.a.ii above for a detailed discussion on our decision to eliminate this requirement from today's rule.

We are also finalizing three additional provisions today. Two of these provisions are being finalized for all equipment manufacturers, and therefore small business equipment manufacturers may also take advantage of them. These are the Technical Hardship Provision and the Early Tier 4 Engine Incentive Program, and are discussed in greater detail in sections III.B.2.b and e above. The third provision is being finalized for small business equipment manufacturers only, for the 20-50 hp category. This provision is discussed in greater detail in section III.C.2.b.ii above.

iii. Provisions for Small Refiners

As previously discussed, we are finalizing standards for locomotive and marine diesel fuel today. Below are the regulatory transition and hardship provisions that we are finalizing to minimize the degree of hardship imposed upon small refiners by this program. With these provisions we are confident about going forward with the 500 ppm sulfur standard for NRLM diesel fuel in 2007, and the 15 ppm sulfur standard for nonroad diesel fuel in 2010 and locomotive and marine diesel fuel in 2012, for the rest of the industry. Given the small refiner relief provisions that are being finalized today, small refiners will be the only refiners permitted to continue selling 500 ppm fuel to nonroad, locomotive, and marine markets from 2010 until 2014 without the use of credits.

We are finalizing delayed compliance for small refiners today ("NRLM Delay" option). We are confident with going forward with these sulfur standards given the regulatory transition provisions being offered for small refiners. These delayed standards would allow for the continued production of higher sulfur NRLM fuel until June 1, 2010, and similarly, for the production of 500 ppm NRLM fuel until June 1, 2014.[255] This is identical to the relief proposed in the NPRM (which small refiners considered sufficient and supported) with the exception that it applies not only to nonroad fuel, but also to locomotive and marine fuel given the decision to finalize 15 ppm sulfur standards for locomotive and marine diesel fuel. Table X.C-2 below illustrates the delayed standards in relation to the general program. This delay option is not being finalized for the Northeast and mid-Atlantic areas due to the removal of the heating oil marker in these areas. However this is not expected to impact small refiners, and this will provide significant relief for small terminal operators. Further, this provision will be finalized in Alaska only if a refiner gets an approved compliance plan for segregating their fuel to the end user.

[255] Since new engines with sulfur sensitive emission controls will begin to become widespread during this time, small refiner fuel will need to be segregated and only supplied for use in pre-2011 nonroad equipment or in locomotives or marine engines.

We also are finalizing transition provisions to encourage early compliance with the standards being finalized today. These provisions are:

- **The NRLM credit option-**
  Some small refiners have indicated that they might need to produce fuel meeting the NRLM diesel fuel sulfur standards earlier than required under the small refiner program described above (distribution systems might limit the number of grades of diesel fuel that will be carried, it may be economically advantageous to make compliant NRLM diesel fuel earlier to prevent losing market share, etc.) This option allows small refiners to participate in the NRLM diesel fuel sulfur credit banking and trading program discussed in section IV. Generating and selling credits could provide small refiners with funds to help defray the costs of early NRLM compliance.
- **The NRLM/Gasoline Compliance Option-**
  This option is available to small refiners that produce greater than 95 percent of their NRLM diesel fuel at the 15 ppm sulfur standard by June 1, 2006 and elect not to use the provision described above to earn NRLM diesel fuel sulfur credits for this early compliance.[256] For small refiners choosing this option the applicable small refiner annual average and per-gallon cap gasoline sulfur standards will be increased by 20 percent for the duration of the interim program; however, in no case may the per-gallon gasoline sulfur cap exceed 450 ppm.

A small refiner may choose to use the relaxed standards (the NRLM Delay option), the NRLM Credit option, or both in combination. Thus any fuel that it produces from crude at or below the sulfur standards earlier than required will qualify for generating credits. However, the NRLM/Gasoline Compliance option may not be used in combination with either the NRLM Delay option or the NRLM Credit option, since a small refiner must produce at least 85 percent of its NRLM diesel fuel at the 15 ppm sulfur standard under the NRLM/Gasoline Compliance option.

Small refiners that choose to make use of the delayed nonroad diesel sulfur requirements would also delay to some extent the emission reductions that would otherwise have been achieved. However, the overall impact of these postponed emission reductions would be small in comparison to the overall program benefits, as small refiners represent only a fraction of national non-highway diesel production. Further, we are aware of some small refiners that plan to take advantage of one of the flexibility provisions that encourages early compliance with the standards. Absent specific provisions for small refiners, we would have to consider delaying the overall

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[256] This is down from the 100 percent requirement proposed to allow for some contamination losses in the process of delivering fuel from the refinery. As discussed earlier in this section, production volumes in the final rule are based upon actual delivered volumes. The 5 percent allowance for greater than 15 ppm fuel should provide adequate flexibility for any refiner's contamination issues, while not providing any opportunity to significantly alter their compliance plans.

program until the burden of the program on many small refiners was diminished, which would delay the air quality benefits of the overall program. By providing temporary relief to small refiners, we are able to adopt a program that expeditiously reduces NRLM diesel fuel sulfur levels in a feasible manner for the industry as a whole.

Table X.C-2. – Sulfur Standards for the Nonroad Diesel Fuel Small Refiner Program (*in parts per million (ppm)*)[a]

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015+
Non-Small- NR	--	500	500	500	15	15	15	15	15	15
Non-Small- LM	--	500	500	500	500	500	15	15	15	15
Small- all fuel	**--**	**--**	**--**	**--**	**500**	**500**	**500**	**500**	**15**	**15**

Notes: [a] New standards are assumed to take effect June 1 of the applicable year.

iv. Provisions for Small Distributors and Fuel Marketers

Though we did not propose any specific regulatory relief for small distributors and marketers of nonroad fuel, we are finalizing provisions to avoid the negative impact to small terminal operators raised in the public comments on our NPRM (that heating oil marker requirements would force small terminal operators to install expensive injection equipment and that they would not be able to recoup the costs). To mitigate the burden on these operators, terminals in much of PADD 1 will not have to add the fuel marker to home heating oil. No small refiner or credit fuel could be sold in this exclusion area. The exclusion area covers the vast majority of heating oil that will be marketed. Further, very little fuel above 500 ppm will be marketed outside of the exclusion area except directly from the refinery gate. Therefore, we expect that few terminals outside of the exclusion area would need to put in injection equipment.

6. Conclusion

A cost-to-sales ratio test, a ratio of the estimated annualized compliance costs to the value of sales per company, was performed for these entities during the proposal stage of the rulemaking.[257] From this cost-to-sales test, we found that approximately four percent (13 companies) of small entities in the engine and equipment manufacturing industry would be affected by between one and three percent of sales (i.e., the estimated costs of compliance with the rule would be greater than one percent, but less than three percent, of their sales). One percent (four companies) of small entities would be affected by greater than three percent. In all, 17 of the

[257] The cost-to-sales ratio test assumes that control costs are completely absorbed by each entity and does not account for or consider interaction between manufacturers/producers and consumers in a market context.

518 potentially affected small engine and equipment manufacturers are estimated to have compliance costs that could exceed one percent of their sales. (A complete discussion of the costs to engine and equipment manufacturers as a result of this final rule is located in Chapter 6 of the Final Regulatory Impact Analysis.)

Based on our outreach, fact-finding, and analysis of the potential impacts of our regulations on small businesses, it was determined that small refiners in general would likely experience a significant and disproportionate financial hardship in reaching the objectives of the nonroad diesel fuel sulfur program. One indication of this disproportionate hardship for small refiners is the relatively high cost per gallon projected for producing nonroad diesel fuel under the proposed program. Refinery modeling (of all refineries), indicates significantly higher refining costs for small refiners. Specifically, without special provisions, refining costs (for full compliance with the 15 ppm sulfur standards) for small refiners on average would be about 7 cents per gallon compared to about 5.7 cents per gallon for non-small refiners. (A complete discussion of the fuel-related costs as a result of this final rule is located in Chapter 7 of the Final Regulatory Impact Analysis.) However, we believe that the regulatory transition provisions that we are affording to small entities will significantly minimize this impact on these entities.

In addition, as contemplated by section 212 of SBREFA, EPA is also preparing a compliance guide to help small entities comply with this rule. This guide will be available within 60 days of the effective publication date of this rulemaking, and will be available on the Office of Transportation and Air Quality website. Small entities may also contact our office to obtain copies of the compliance guide.

D. Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), Public Law. 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 of 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. EPA believes that the final rule represents the least costly, most cost-effective approach to achieve the air quality goals of the rule. The costs and benefits associated with the final rule are discussed above and in the Regulatory Impact Analysis, as required by 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."

Under section 6 of Executive Order 13132, EPA may not issue a regulation that has federalism implications, that imposes substantial direct compliance costs, and that is not required by statute, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by State and local governments, or EPA consults with State and local officials early in the process of developing the proposed regulation. EPA also may not issue a regulation that has federalism implications and that preempts State law, unless the Agency consults with State and local officials early in the process of developing the proposed regulation.

Section 4 of the Executive Order contains additional requirements for rules that preempt State or local law, even if those rules do not have federalism implications (i.e., the rules 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). Those requirements include providing all affected State and local officials notice and an opportunity for appropriate participation in the development of the regulation. If the preemption is not based on express or implied statutory authority, EPA also must consult, to the extent practicable, with appropriate State and local officials regarding the conflict between State law and Federally protected interests within the agency's area of regulatory responsibility.

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 has also consulted representatives from STAPPA/ALAPCO, which represents state and local air pollution officials.

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, including from the State of Alaska.

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 6, 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. This rule will be implemented at the Federal level and impose compliance costs only on engine manufacturers and diesel fuel producers and distributors. Tribal governments will be affected only to the extent they purchase and use equipment with regulated engines. Thus, Executive Order 13175 does not apply to this rule.

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, Section 5–501 of the Order directs the Agency to 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 rule is not subject to the Executive Order because it does not involve decisions on environmental health or safety risks that may disproportionately affect children. The EPA believes that the emissions reductions from the strategies proposed in this rulemaking will further improve air quality and will further improve children's health.

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:

We have prepared a Statement of Energy Effects for this action as follows.

This rule's potential adverse effects on energy supply, distribution, or use have been analyzed, and are discussed in detail within the following documents:

1. Fuel provisions of the rule and flexibilities, including hardship provisions, are described in this Preamble, section IV.B. The provision of sufficient lead time for refiners is discussed in section IV.F.
2. Potential impacts on fuel supplies are summarized in Preamble section VI.A.5, RIA section VI.A.5, and within the Summary and Analysis of Comments document, section 4.6.3.
3. Costs of low-sulfur fuel are discussed in Preamble section VI.F, and RIA Chapter 7 (demand and production in 7.1, and refining costs in 7.2).
4. Price impacts are summarized in Preamble section VI.A, and RIA section 7.6, with distribution costs in section 7.4, alternative estimates of costs in 7.2, and effects of alternative demand projections in 7.2 as well. Uncertainty in fuel demand is also discussed in the Summary and Analysis of Comments section 2.3.2.2.
5. The need for adequate short-term investment in low sulfur refining capacity is addressed in RIA section 5.9.
6. The impacts of regulatory alternatives that were considered are discussed in Preamble section VII.

In summary, the cost of No. 2 distillate nonroad fuel is projected to increase overall by approximately 7 cents per gallon (in 2002 dollar terms) as a result of this rule. This would have a very small effect on production (projected reduction of approximately 0.02 %, or less than 4 million gallons per year by 2036).

The analysis also concludes that we do not expect this rule to have any adverse effect on the supply or distribution of NRLM fuel, nor to result in a significant increase in imports of NRLM fuel. Refiners will be unlikely to leave the NRLM fuel market and are unlikely to shut down due to this rule.

Price impacts will vary regionally in the U.S., and are difficult to project precisely. Analysis of various scenarios in RIA section 7.6 suggests that in PADDs 1 and 3 as well as 2, which account for the bulk of demand, prices could increase by almost 11 cents per gallon in the unlikely “maximum total cost” scenario of constrained capacity. In contrast, the "average total cost" scenario predicts a 5 cent per gallon increase in PADDs 1 and 3.

We do not believe there are any reasonable alternatives to the control of sulfur in nonroad fuel which would allow the reduction in NO_X and PM emissions from nonroad equipment required by today's rule. There are also no reasonable alternatives to the control of sulfur in locomotive and marine fuel which would provide the associated reductions in sulfur dioxide and sulfate PM emissions provided by the 500 and 15 ppm caps on the sulfur content of this fuel.

I. National Technology Transfer Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act of 1995 (“NTTAA”), Public Law 104-113, section 12(d) (15 U.S.C. 272 note) directs EPA to use voluntary consensus standards in its regulatory activities unless doing 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 involves technical standards. The following paragraph describes how we specify testing procedures for engines subject to this proposal.

The International Organization for Standardization (ISO) has a voluntary consensus standard that can be used to test nonroad diesel engines. However, the current version of that standard (ISO 8178) is applicable only for steady-state testing, not for transient testing. As described in the Regulatory Impact Analysis, transient testing is an important part of the new emission-control program for these engines. We are therefore not adopting the ISO procedures in this rulemaking.

J. 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 before the rule is published in the Federal Register. This rule is a “major rule” as defined by 5 U.S.C. 804(2).

XI. Statutory Provisions and Legal Authority

Statutory authority for the engine controls adopted today 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, 42 U.S.C. 7547, 7522, 7523, 7424, 7525, 7541,7542, 7543, 7550 and 7601.

Statutory authority for the new fuel controls is found in sections 211 (c) and 211 (i) of the Clean Air Act, which allow EPA to regulate fuels that either contribute to air pollution which endangers public health or welfare or which impair emission control equipment which is in general use or has been in general use. 42 U.S.C. 7545 (c) and (i). Additional support for the procedural and enforcement-related aspects of the fuel controls in the final rule, including the record keeping requirements, comes from sections 114 (a) and 301 (a) of the CAA. 42 U.S.C. sections 7414 (a) and 7601 (a).

List of Subjects

40 CFR Part 9

Reporting and recordkeeping requirements.

40 CFR Part 69

Environmental protection, Air pollution controls.

40 CFR Part 80

Fuel additives, Gasoline, Imports, Incorporation by reference, Labeling, Motor vehicle pollution, Penalties, 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 94

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

40 CFR Part 1039, 1048, and 1051

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 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_____

ORIGINAL SIGNED BY MICHAEL LEAVITT
MAY 11, 2004

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Michael O. Leavitt, Administrator